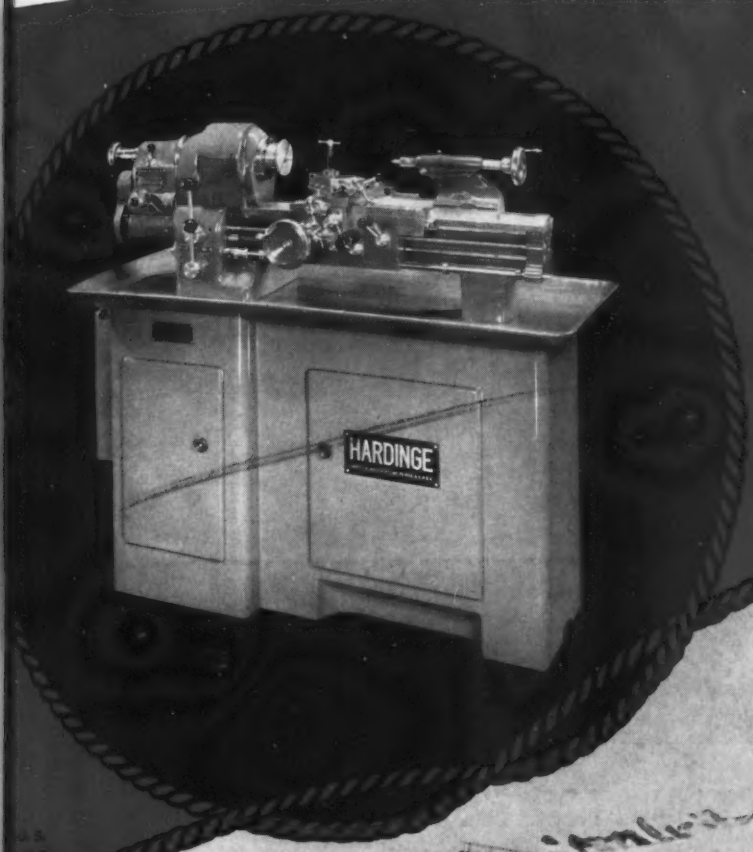
MERCHANT SHIPBUILDING—DECEMBER 1943

DEC 15 1943

MACHINERY



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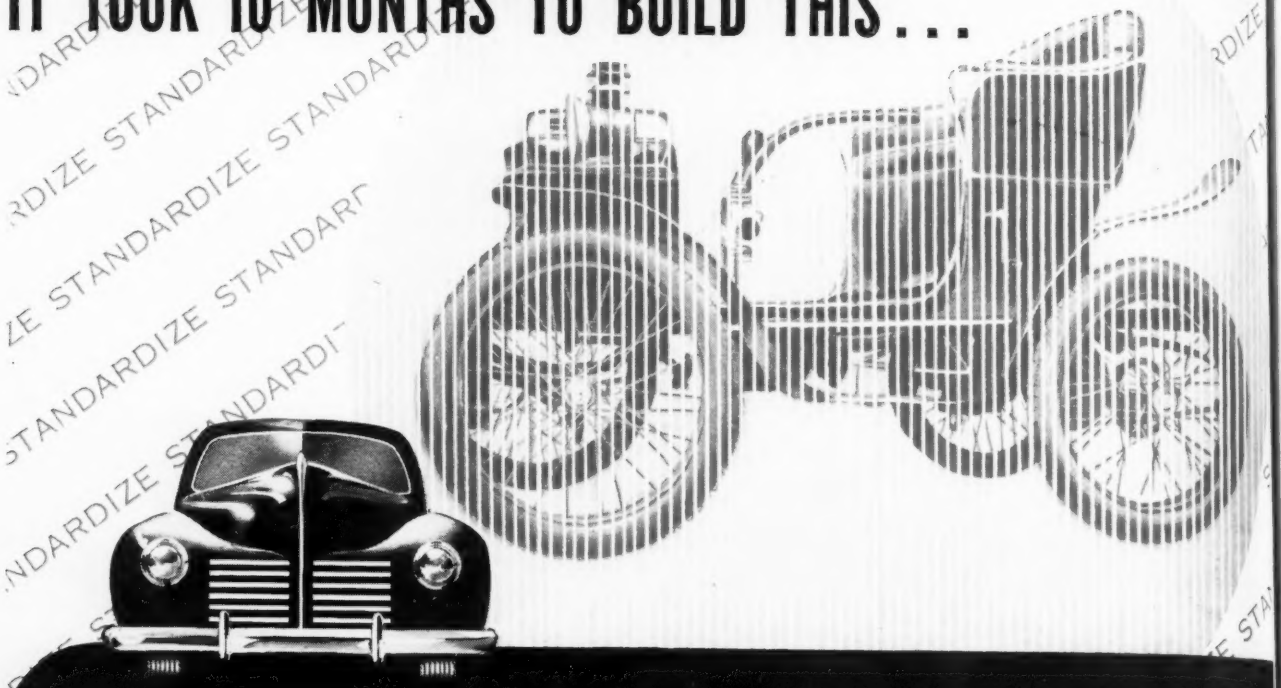
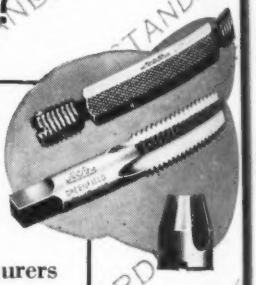


in 1 minute they roll out 4 of these

WHAT'S THE BIGGEST REASON FOR THE DIFFERENCE?



The Duryea Brothers' first "horseless carriage" was a triumph of individual ingenuity, but their original manufacturing methods would never have put America on wheels. Nor would they have enabled us to produce the volume of planes, tanks, and guns that are winning the war today.

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DESIGN, CONSTRUCTION, OPERATION OF METAL-WORKING AND ALLIED EQUIPMENT

MACHINERY

DECEMBER, 1943

What is likely to happen in industrial America during the coming post-war period? Will the pent-up demands for automobiles, refrigerators, radios, and many other products utilize our greatly expanded manufacturing facilities? To what extent will wartime developments result in the production of new appliances that can be used to advantage when the war ends? Such questions are in the minds of almost everyone. No one expects to obtain a post-war blueprint, complete with all of the details of things to come, but the January issue of MACHINERY will bring you the predictions and opinions of an imposing array of outstanding leaders in industry, as expressed in interviews obtained especially for MACHINERY.

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Number 4

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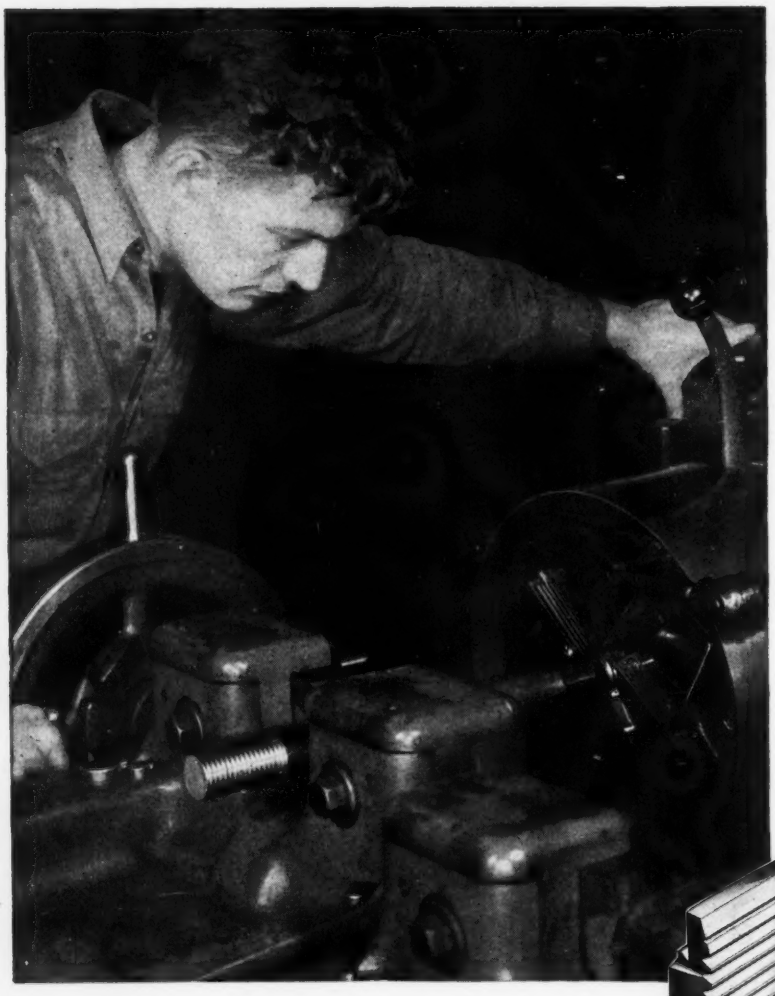

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SHIPS ★ ★ ★ *to Maintain Freedom's Lifelines*

AMERICA is building the greatest fleet of cargo vessels in the history of the world to maintain a bridge of supplies to the far-flung battle lines of the United Nations. More than 2000 ships of various types with an aggregate of approximately nineteen million tons deadweight will be built in 1943—a fabulous number gaged by prewar standards. This number of MACHINERY, published with the cooperation of the United States Maritime Commission, describes methods by which our phenomenal ship production is being attained.

Official U. S. Navy Photo

MACHINERY

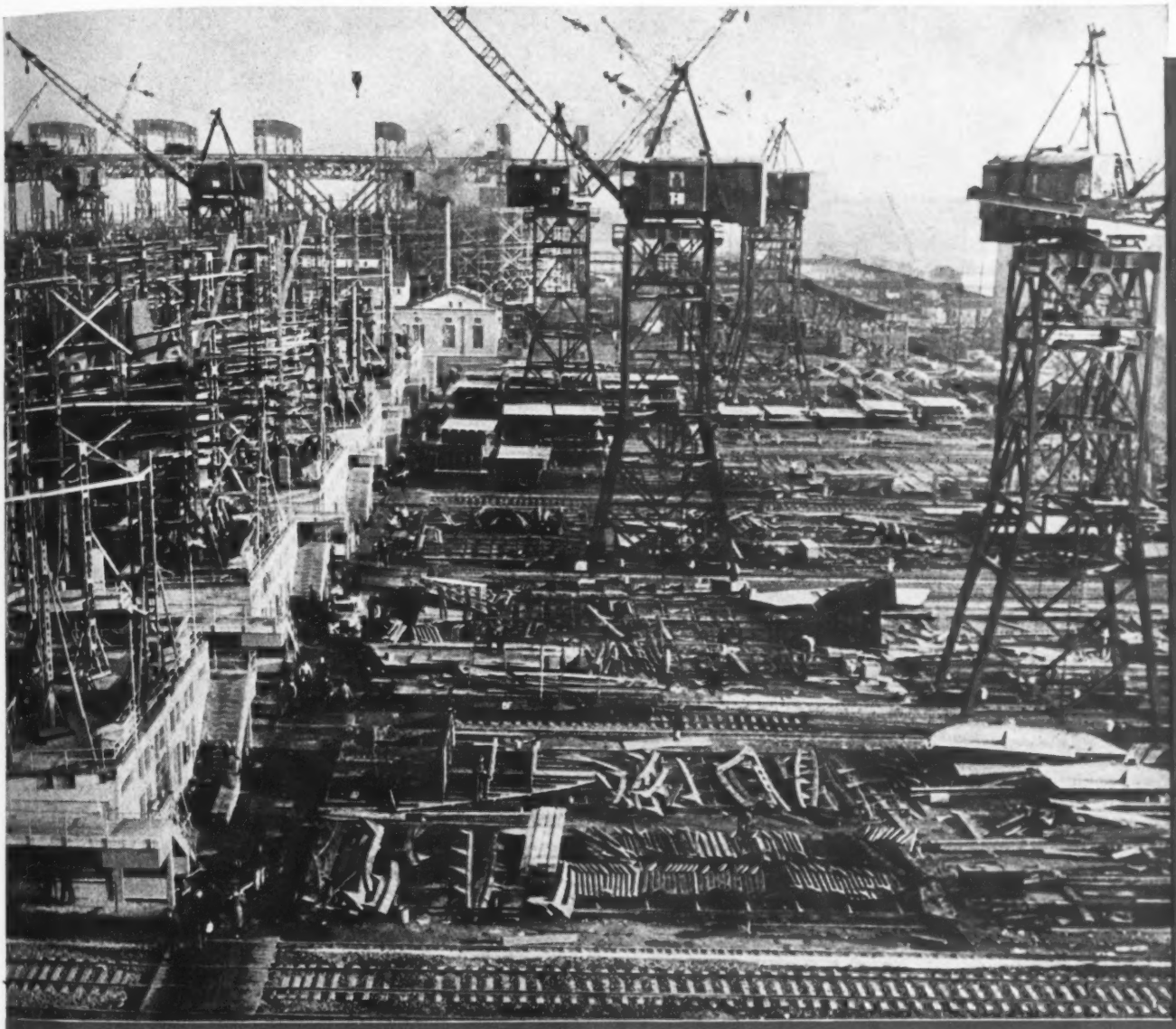
Volume 50 DECEMBER, 1943 Number 4

THE BIGGEST *the World*

By REAR ADMIRAL
HOWARD L. VICKERY, U. S. N.
Vice-Chairman United States
Maritime Commission, and
Deputy Administrator War
Shipping Administration

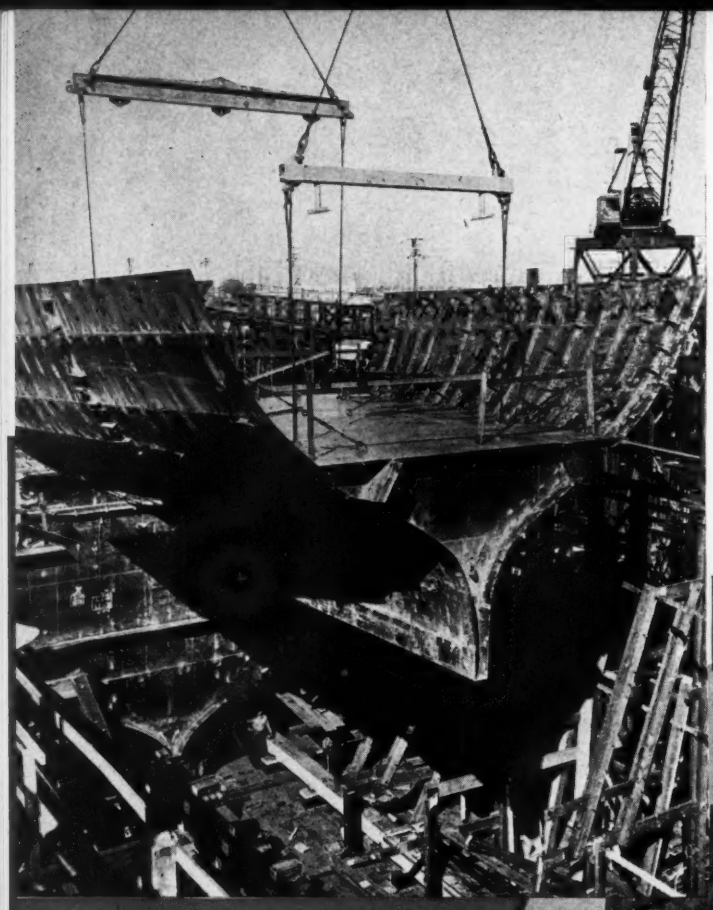
SHIPBUILDING PROGRAM

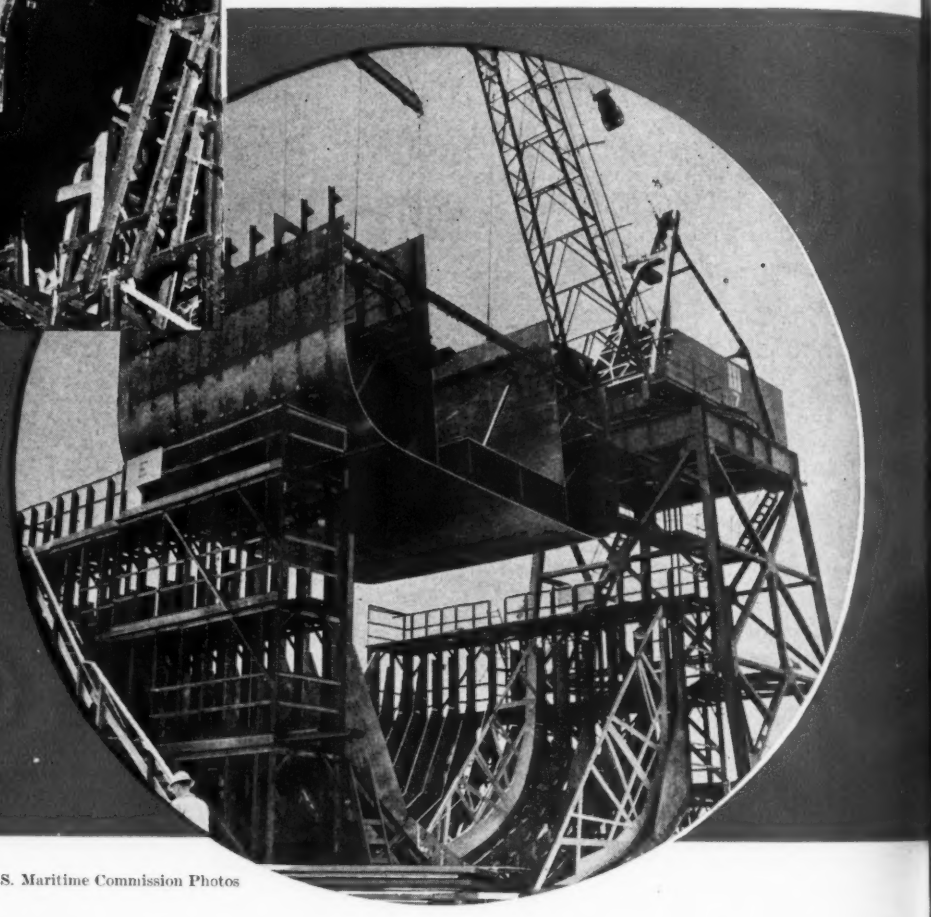
Has Ever Seen



Courtesy of Bethlehem-Fairfield Shipyard

DEMAND for ships in this global war is almost without limit. Conditions under which the United Nations have to wage war against the Axis makes it obvious that one of the prime essentials of our strategy is shipping. Even before the United States was drawn into the war, the United States Maritime Commission's building program had been increased. But when our path had been clearly defined in December, 1941, the need became acute. Since then, the resources of material and manpower possessed by the United States have enabled us to become shipbuilders for the United Nations, and vessels built in our shipyards since Pearl Harbor have had a conspicuous part in halting the threat of the Axis powers.





Mass Production Shipbuilding Methods on a Scale Considered Impossible in Prewar Days have Enabled American Shipyards to Establish Fantastic Records. These Illustrations Show Large Sections for Escort Vessels being Transferred from the Jigs in which They were Constructed directly to Shipways

U. S. Maritime Commission Photos

THE BIGGEST SHIPBUILDING

shipping had been built in 1942. Every ship construction record was broken that year, which witnessed the progress of the Liberty ship program from delivery of three vessels in January to eighty-two in December. While the record for 1942 was remarkable, it was only a forerunner of the accomplishments of 1943. By July, the 1943 shipbuilding program had far exceeded the totals of the year before. In the first half of 1943, as many as 879 vessels of various kinds,

The shipbuilding program that set so many records in 1942 continued to set new ones in 1943. A tremendous challenge had been offered United States shipbuilders at the beginning of 1943, when the year's construction goal was set at approximately 19,000,000 tons deadweight. The challenge was not only to increase the construction of tonnage by much more than twice that built in 1942, but to expand building operations almost to the limit of our capacity, as defined by the availability of materials and of manpower.

More than 8,000,00 tons deadweight of new aggregating 8,813,990 tons deadweight, were delivered, compared with 746 in all of 1942.

The month of March was a milestone in the program. In the latter days of that month, merchant shipyards attained a national average of five deliveries per day; it was the first month in which tonnage construction passed the 1,500,000 mark, and the first month in which Liberty ship deliveries exceeded 100. All these marks were maintained or exceeded in the third quarter.

As September ended, 1361 ships had been delivered under the 1943 program. Total tonnage for the nine months was 13,826,313 tons dead-

weight. The banner month of the year, and in fact of the whole program through the third quarter of 1943, was May. In that month, there were 176 vessels aggregating 1,782,836 tons deadweight delivered. The second best month was June, with 167 ships of 1,670,442 tons.

The Liberty ship program continued in 1943 to furnish 65 to 70 per cent of the total construction. In the first half of the year, 608 of these sturdy ships were delivered, compared with 542 in all of 1942. In the third quarter, 325 more were delivered, bringing the total number of Liberty ships to almost 1500 since the first—the *Patrick Henry*—was delivered within a few days after the attack on Pearl Harbor.

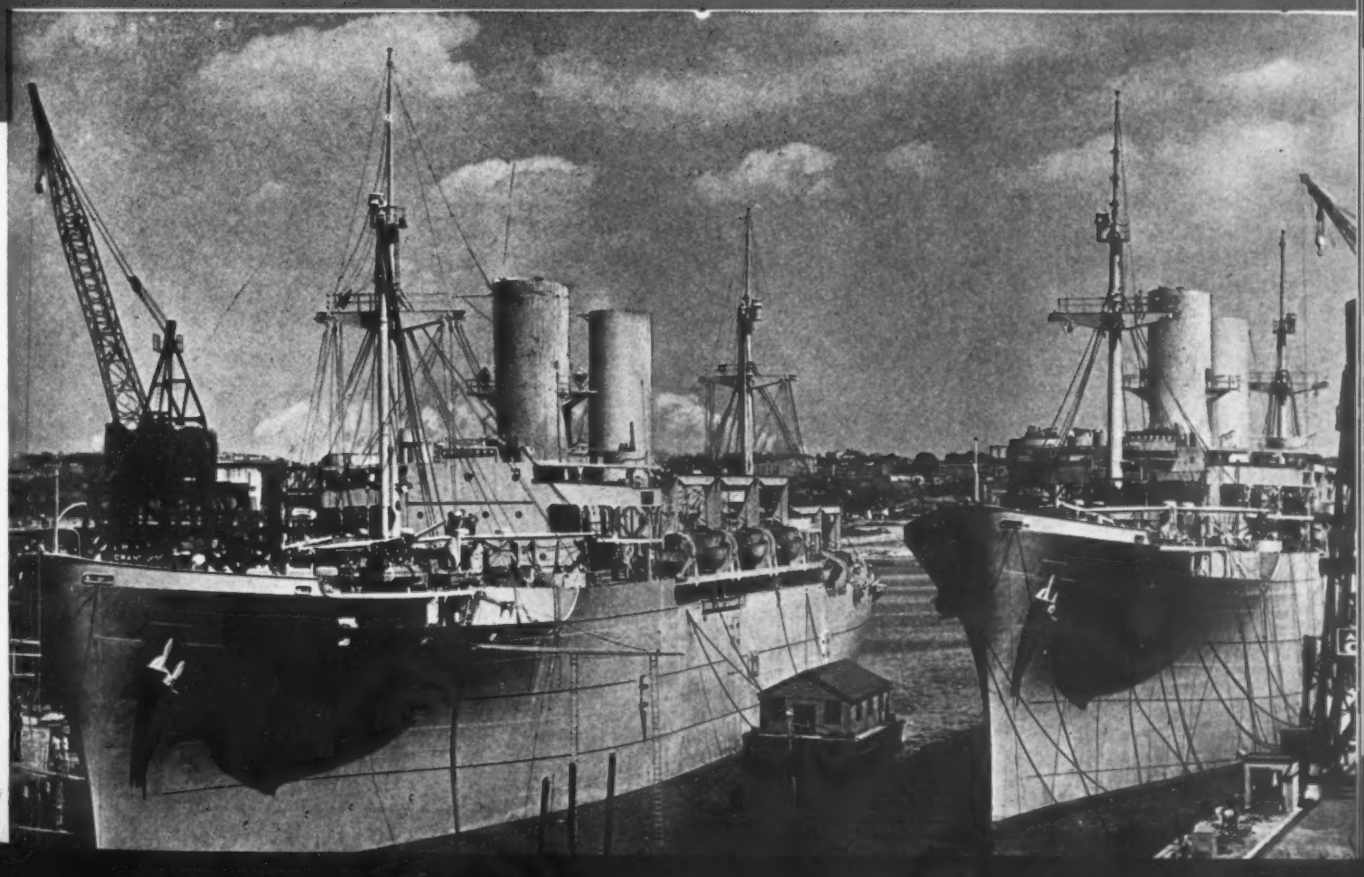
Too much credit cannot be given the Liberty ships in this war, for they have carried a great responsibility. They have given unfaltering service to the United Nations, for they have sailed the seven seas in delivering lend-lease goods, in transporting troops and equipment to world battlefronts, and aiding in the invasions of Axis-held territory. Many of them have survived terrific punishment from enemy raiders. A great share of glory in the victory that is coming will fall to these vessels, which filled so great a need at such a critical time.

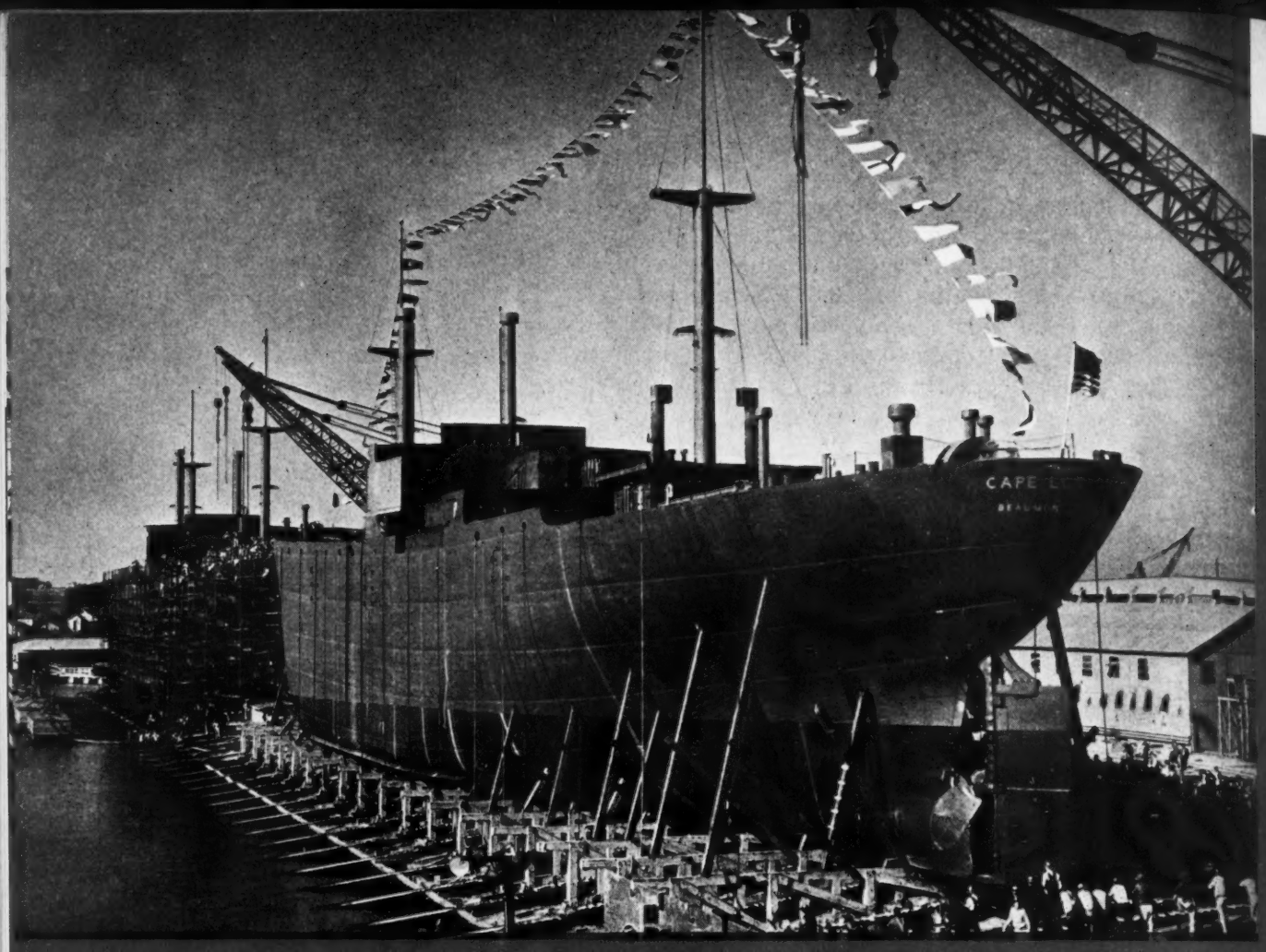
The Liberty ship program has taught us several lessons. It has demonstrated that with new techniques of construction and proper coordination of factory production with shipyard schedules, ships can be built on a mass production basis. It has shown that standardized ships can be built in as little as an average of twenty days in the regular sequence of construction, with some yards delivering individual ships in as short a time as sixteen days from keel laying. The methods developed will have great influence on the future course of shipbuilding.

Records made in the last two years have had Liberty ship construction as their prime factor. But aside from the growth of the Merchant Marine in tonnage and number of ships, the program grew in other directions. There was more emphasis put on the construction of C type cargo vessels. The tanker program grew to greater proportions. And the Victory ship, which is planned to supersede the Liberty type eventually, was designed and initial deliveries were scheduled for the spring of 1944.

Increased construction of C type ships, the fine, modern vessels with which the Maritime Commission started its peacetime construction program in 1937, was hampered in the early

First Pair of New Series of Big Army Transports in the Wet Basin at the Federal Shipyard of the United States Steel Corporation





U. S. Maritime Commission Photo

Cargo Vessel Ready for Sidewise Launching at Pennsylvania Shipyards, Inc., Beaumont, Tex.

part of 1942 by the lack of facilities for manufacturing geared turbine propulsion equipment in sufficient quantity. But, due to sustained efforts by the Commission to remedy this situation, new manufacturing facilities were created and existing ones enlarged. As the modern power became available in quantity, production of the C type ships was increased, and in the first three quarters of 1943, there were built more than twice the number built in all of 1942.

September, 1942, was the month in which the Commission was able to accelerate C type construction. Ten of these vessels were delivered that month, eight in October, five in November, and twelve in December. This total of thirty-five is eleven more than were built in the preceding eight months. Deliveries of C type ships continued to climb in 1943. March and June each produced nineteen. The total at the half-year was eighty-four, and the ensuing quarter produced thirty-eight more.

Increased availability of modern propulsion machinery also enabled tanker construction to increase. Again, the half-year record of tanker construction in 1943 eclipsed the entire record of 1942 by a count of sixty-five to sixty-two. In the year's third quarter, forty-five more were added.

The Victory ship is also a beneficiary of the more abundant supply of modern propulsion equipment. This new vessel has been designed for the mass production methods developed in the Liberty ship program. But it will have greater speed, trimmer lines, and more modern equipment in general than the Liberty ship—characteristics that will make it far more adaptable to the purposes of both war and peace. Its deadweight capacity will be about the same as the Liberty ship.

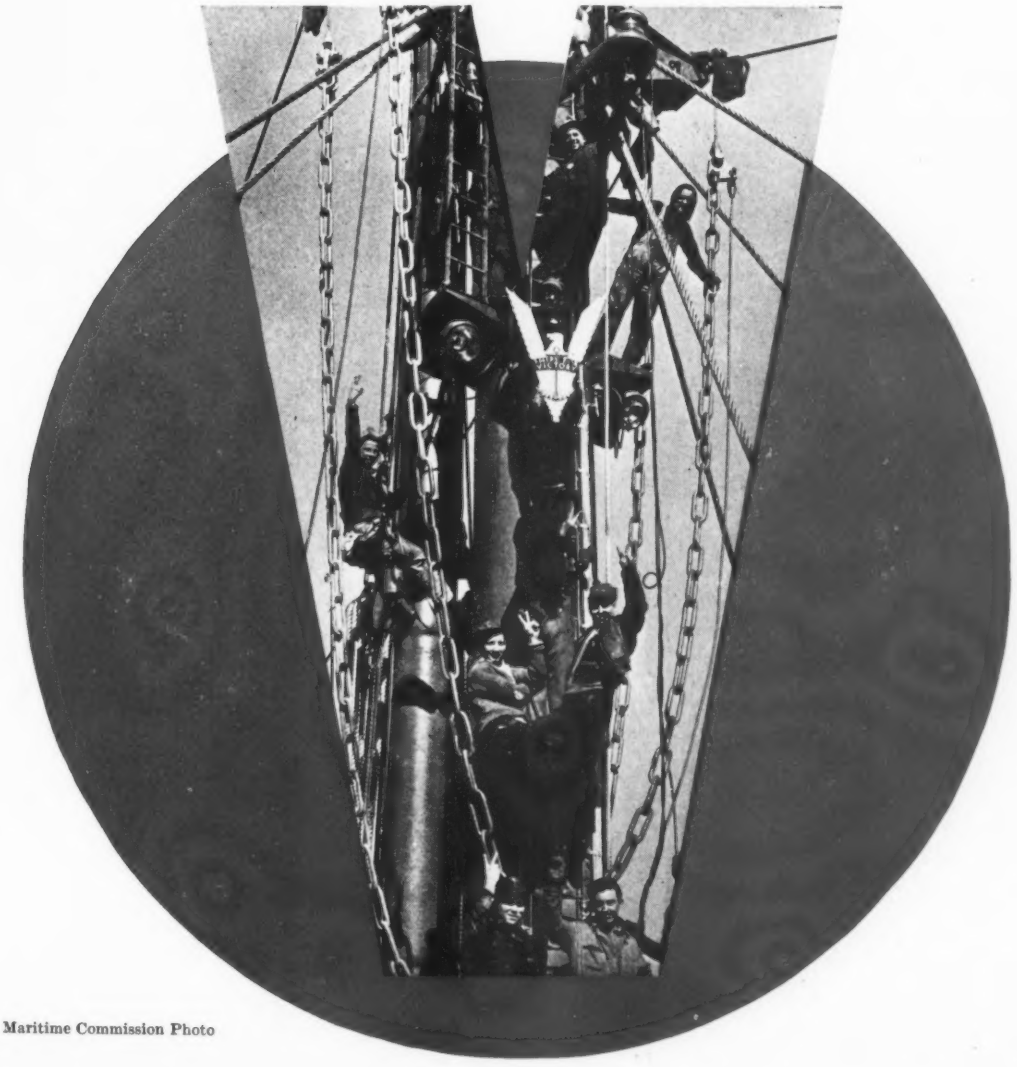
The C type ships, the Victory ships, and the modern, high-speed tankers are the vessels around which the United States' post-war merchant fleet will be built. By the end of 1943 we shall have built over 2700 vessels, with an aggregate of between twenty-seven and twenty-eight million tons deadweight. The course and

scope of the program in the immediate future will depend on the progress of the war. But whatever that course is, the United States will have, at the end of the war, a tremendous merchant fleet.

Transition of the merchant fleet from its war status to peacetime commerce will be one of the first problems. Then, the physical rehabilitation of the war-torn countries undoubtedly will call for a good part of our shipping. Planning of our routes and shipping services, our maritime relations with other nations, and related matters that will affect our maritime future will be under consideration by those who will design our post-war policy.

To aid the formulation of an adequate maritime policy, suited to conditions we may expect in the post-war era, the Commission has established a Post-War Planning Committee. Its membership includes many of the top executives of the Maritime Commission and the War Shipping Administration. This committee is charged with initiating studies and gathering the wealth of information that will be required for plotting the course of our maritime operations under the changed world conditions we shall undoubtedly find.

Post-war problems are far too vast and too intricate for the Commission alone to pass on. The shipping industry is dynamic, but subject to many influences. Therefore, an important part of its post-war planning will be the seeking of counsel and advice from those whose experience and interests entitle them to share in charting the course of our Merchant Marine. The same application of intelligence and determination that our shipbuilders and operators are showing in solving our maritime problems in wartime should lead them into the proper paths of peaceful world commerce.



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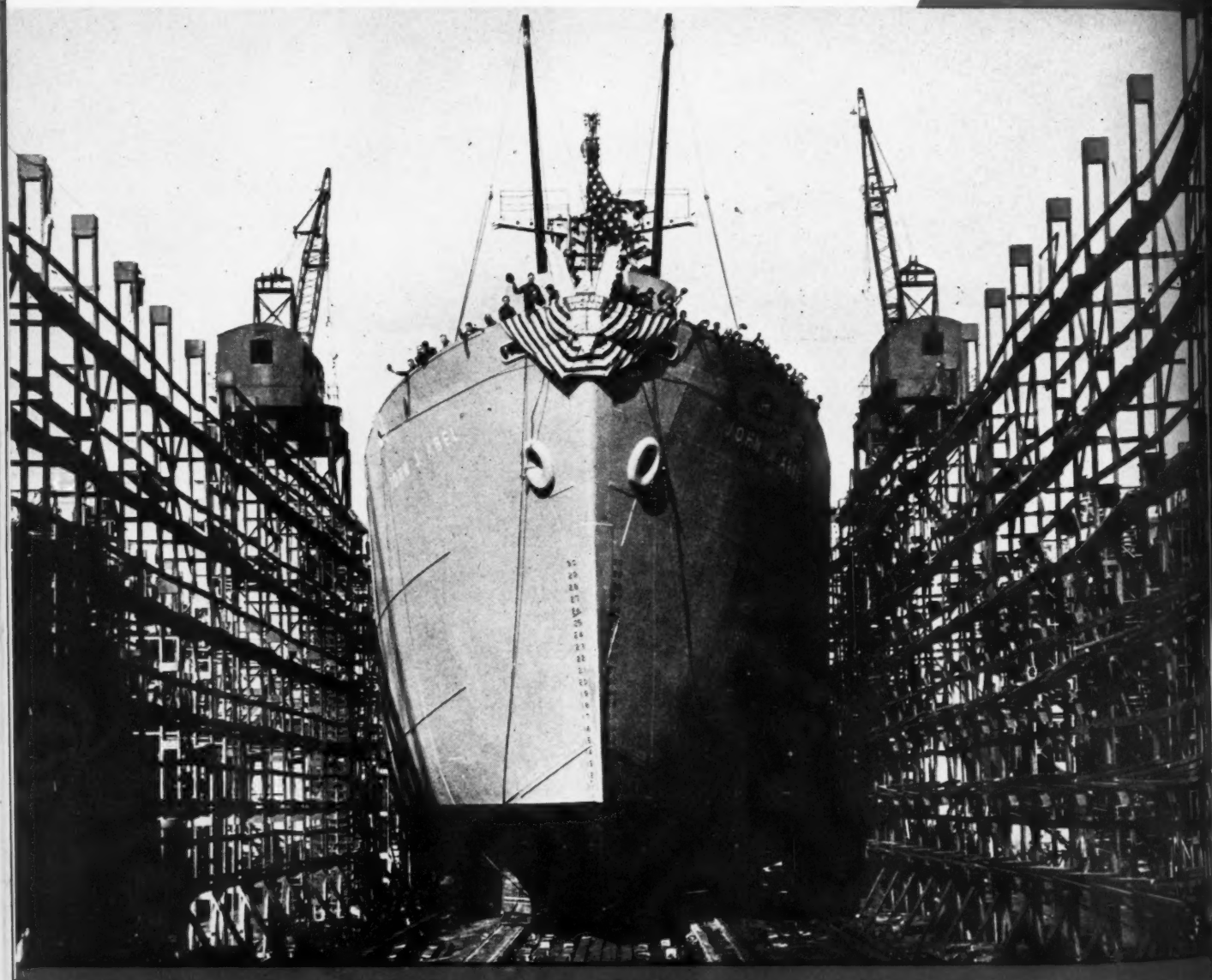
BETHLEHEM-FAIRFIELD

Mass Production Methods Followed in a Shipyard where the Motto Has Been "No Liberty without Victory—No Victory without Liberty Ships"

By CHARLES O. HERB

WHEN the day of victory finally arrives, the Liberty ship must be given generous credit for its share in maintaining the bridge of supplies to our far-flung battle areas. This ship was designed to meet an urgent transportation need in the greatest emergency ever confronted by the nation. Although comparatively slow and lacking the rakish or streamline appearance of the Maritime Commission's C-ships, her design was such that mass production could be carried out on a plan never before conceived in shipbuilding. Liberty ships have consequently been turned out in great numbers within an incredibly short period of time. This fact has enabled us to constantly increase our shipping tonnage in spite of the ravages of enemy submarines.

The biggest builder of Liberty ships on the East Coast is the Bethlehem-Fairfield Shipyard of the Bethlehem Steel Co., which is located in



Largest East-Coast Producer of Liberty Ships

Fig. 1, Assembly Platens in the Fabricating Shop, which is 1660 Feet Long and Laid out for Progressive Production of Ship Sections

the shipyards of Baltimore. This shipyard was the first to build a Liberty ship, and up to November 1 of the present year has launched a total of 235 vessels of this type. They are now being turned out at the rate of twenty-two ships per month from sixteen ways. Obviously, such a production record could be achieved and maintained only through the application of mass fabrication and assembly methods. In addition to Liberty ships, this yard has also built thirty of the Navy's tank landing ships.

Many of the methods employed in the Bethlehem-Fairfield shipyard were evolved in that yard, while others are the result of the pooling of experiences with other shipbuilders. The rank-and-file employes have contributed many worthwhile manufacturing short-cuts through a suggestion system that has been remarkably successful. Every suggestion is considered by the Victory Production Committee, which is composed of representatives of management and labor. About 25 per cent of all suggestions are adopted out of a monthly average of 350, rewards being given for accepted suggestions.

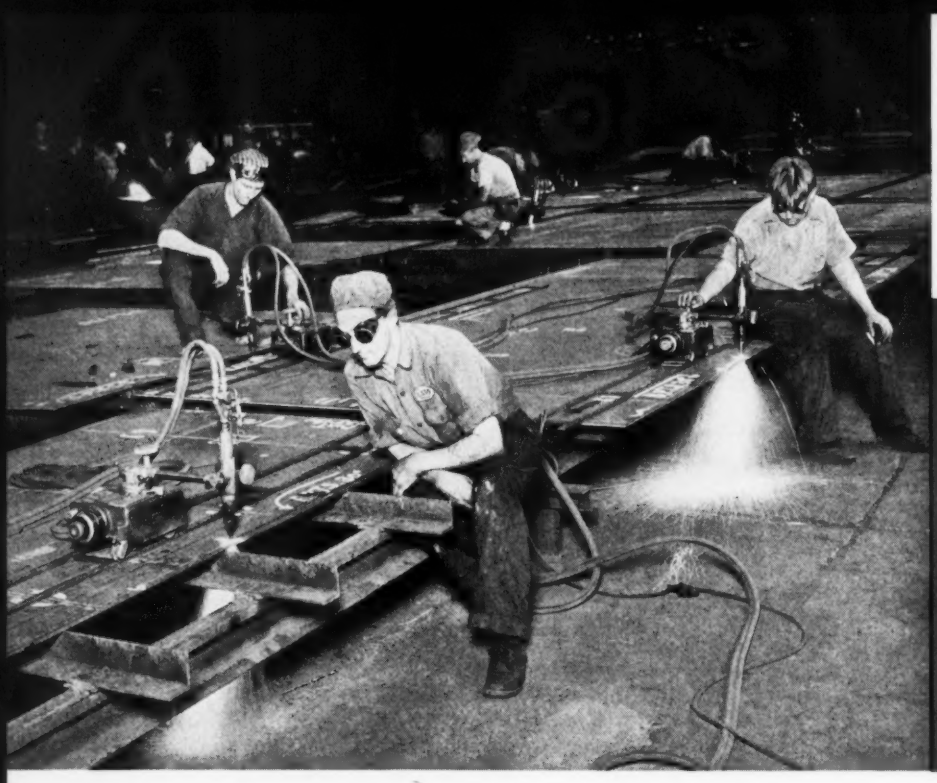


Fig. 2. (Left) Radiograph Oxy-acetylene Machines are Used for over 2,000,000 Feet of Cutting on Steel Plate Monthly in the Bethlehem-Fairfield Fabricating Shop

Fig. 3. (Below) Laying out Steel Ship Plates Ready for Fabrication from Wooden Templets Supplied by the Mold Loft

Ship sections are fabricated in a shop 2 1/2 miles from the shipyard and transported over railroad tracks and by truck to storage areas in the shipyard, ready for quick delivery to the ways as required. Inner bottom sections, deck sections, bulkheads, etc., are cut from steel plate and structural shapes in the fabricating shop and welded together into complete assemblies before being loaded on the cars for delivery to the shipyard. The fabricating shop is 1660 feet long by 270 feet wide, and is divided into three bays that are served by overhead cranes of 86 feet span. Work flows through this shop on a straight-line production basis from the raw material stores at one end of the building to the outgoing railway tracks at the opposite end.

Plates to be fabricated into the various ship sections are first transferred from materials storage to adjacent lay-out tables, where wooden templets are applied in conventional manner to indicate how the plates are to be torch cut, sheared, and punched. Fig. 3 shows a number of employes engaged in marking plates by the use of typical wooden templets. The plates are

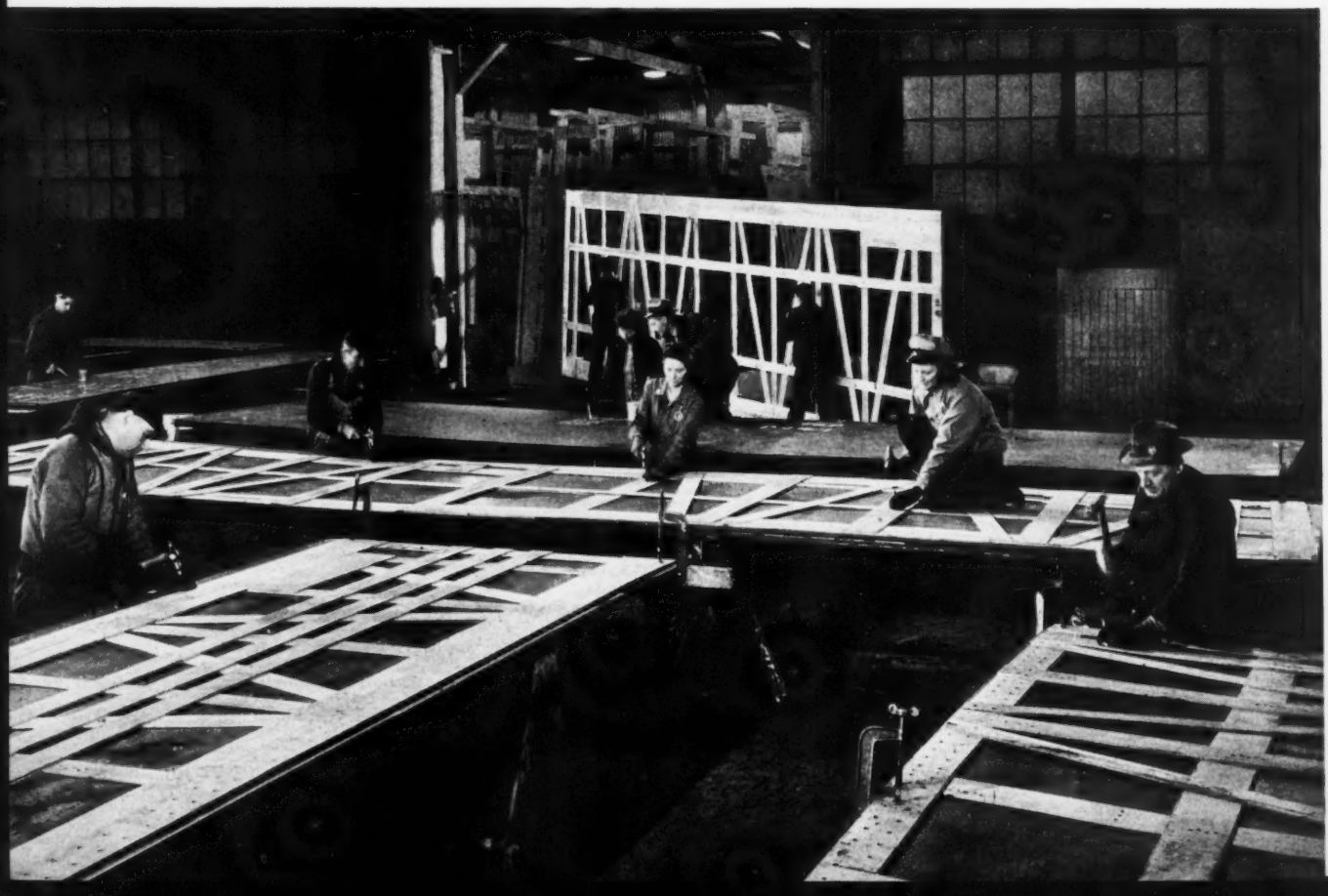


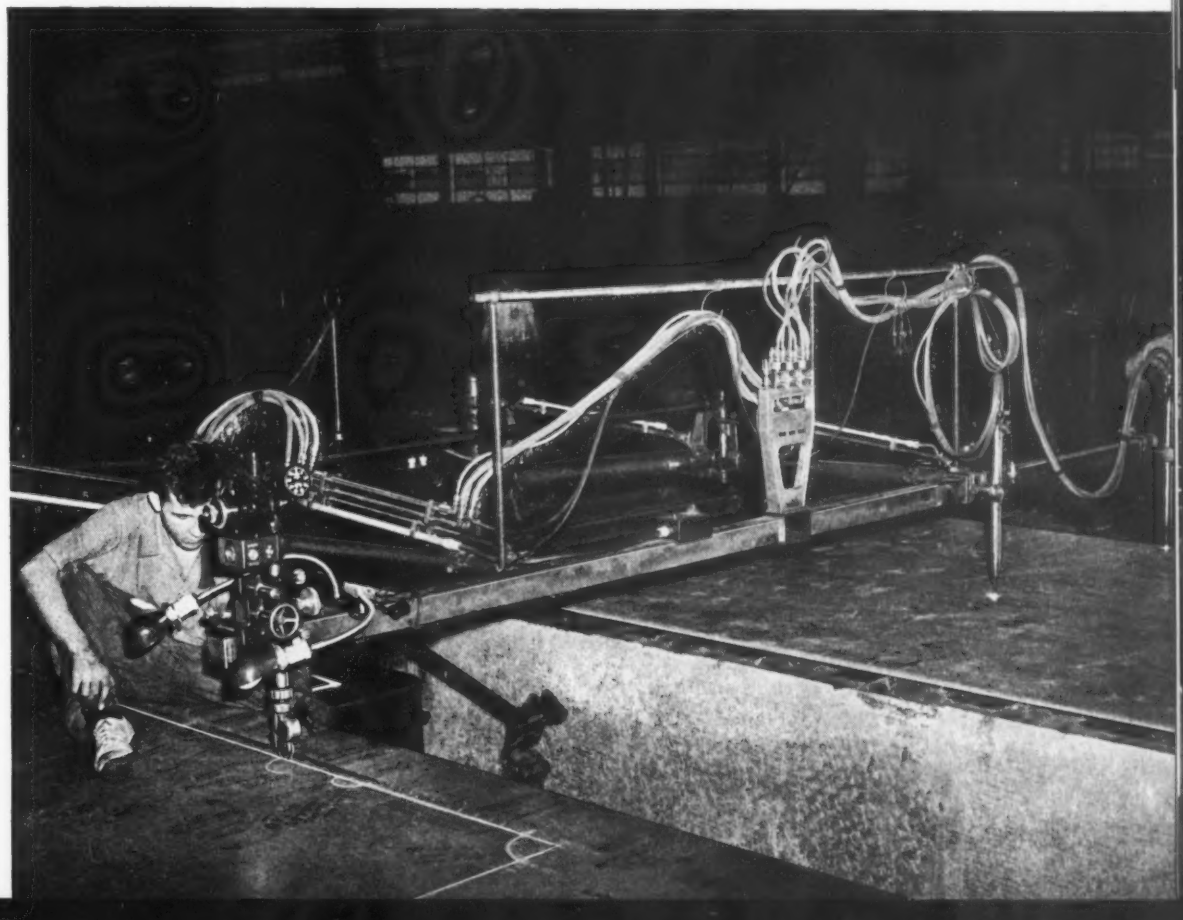
Fig. 4. (Right) Beamograph Two-torch Machines are Extensively Employed for Simultaneously Cutting off the Flanges of Two Channels or Flanges on Opposite Sides of I-beams

Fig. 5. (Below) Travograph Oxy-acetylene Machines are Used for Burning 400,000 Feet through Steel Plate per Month

then moved farther down the shop by overhead cranes to oxy-acetylene burning tables, to punching machines equipped with roller tables for quickly shifting the plates beneath the punch, and to heavy shears. Structural shapes such as channels and angle-irons are moved from storage to bending slabs which are located parallel with the burning tables but in a separate bay. Here the shapes are bent to templets, after they have been heated to a suitable temperature in adjacent furnaces.

Still farther down the shop and also along one side of the building outdoors are large platens where the cut-out plates and bent or straight structural shapes are assembled together by welding into the various ship sections. In Fig. 1 may be seen a general view of this area of the shop in two of the bays. Both electric arc and Unionmelt welding methods are used.

From these areas the assembled ship sections are loaded on open railway cars for transfer to the shipyard. Incidentally, isometric sketches are supplied for every section that goes into a ship for the convenience of unskilled workers



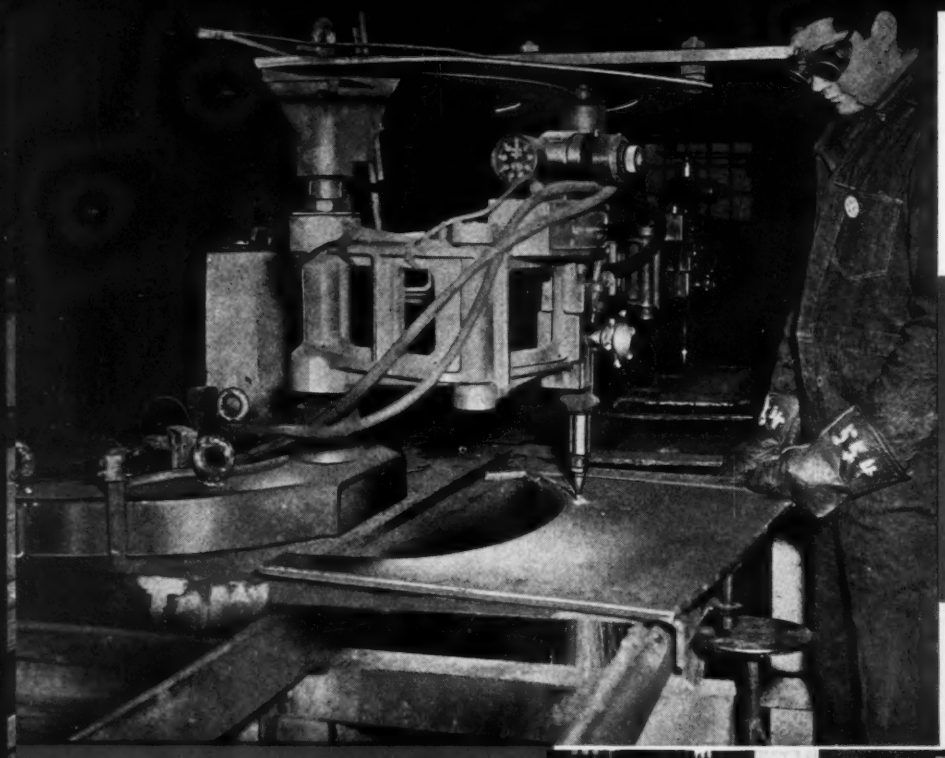


Fig. 6. (Left) Oxy-acetylene Camograph Machine, which is Provided with an Overhead Cam or Templet for Guiding the Cutting Torch Magnetically around Required Paths on Steel Plate

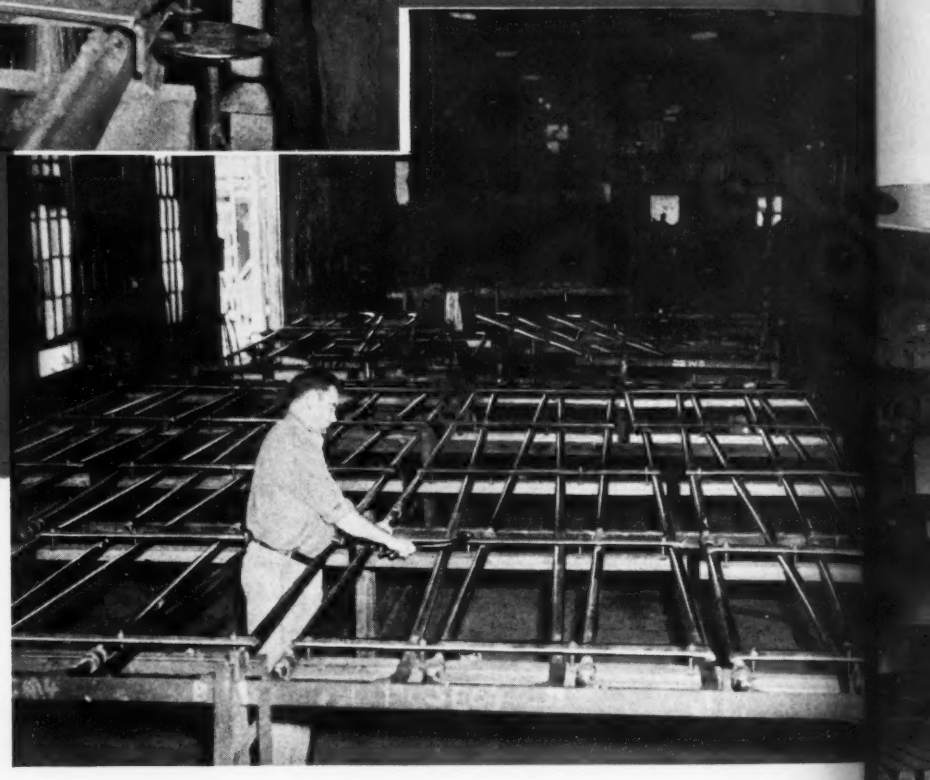


Fig. 7. (Right) Large Structural Jig Employed in Fabricating Pipe Coils to Fit Deep Tanks without the Necessity of Special Fitting aboard Ship

who are not adept at reading regular engineering drawings.

More than 3,000,000 feet of cutting is done on steel plates and shapes per month by means of oxy-acetylene torches, and of this huge amount only about 60,000 feet of the burning is done by hand torches. Radiagraph machines, such as seen in Fig. 2, account for approximately 2,340,000 feet of burning, and Travograph machines, of the type seen in Fig. 5, for approximately 400,000 feet of cutting. In Fig. 5, two plates are seen at the right being simultaneously cut to the required outline as the tracer at the left follows the lines of a steel templet.

Beamograph double-torch machines, of the type illustrated in Fig. 4, are widely employed for simultaneously cutting off the flanges of two channel irons or both flanges on opposite sides of an I-beam, an average of 230,000 feet of cutting being done monthly by machines of this type. Camograph machines are extensively used for cutting small brackets, clips, chocks, and other pieces of comparatively small dimensions and of irregular form. These machines are provided with an overhead steel templet, as illustrated in Fig. 6, which is engaged by a magnetic roller that automatically moves the cutting torch through the desired path around the work.

Unionmelt welding machines are employed not only for the flat butt-welding of deck plates and similar operations, but also for welding in the corners formed by upright shapes on flat plates.

The pipe department at the fabricating shop

has adopted the use of structural jigs to insure that pipe units will fit interchangeably into a ship without the necessity of taking measurements on a vessel and "tailoring" the pipe to suit. Several of these pipe jigs are seen in Fig. 7. In the foreground is a jig that is used in fabricating the heating coil for the forward deep tank an the starboard side of a Liberty ship. This coil consists of straight lengths of pipe and bent U-shaped ends which are arc-welded to the straight lengths. The straight lengths are located in the jig the required distance apart by means of steel straps, and the U-shaped ends are located lengthwise by the angle-iron frame of the jig.

With the parts thus lined up, the U-shaped ends and straight lengths are first tack-welded together, and then completely welded. The use of jigs for these pipe coils has saved a great deal of installation time, because the coils always fit the tanks, although the over-all allowance is only 3 inches.

A similar jig is used in fabricating the heating coil for the forward deep tank on the port side, and in making up the coils for settling tanks. This jig is about 27 feet long by 15 feet wide. Portions of the structural frame on some jigs can be dropped after the pipes have been tack-welded to facilitate the complete welding. The pipe units are given a hydrostatic test of 500 pounds per square inch to detect any faulty welding before being removed from the jigs.

Fig. 8 shows a 1000-ton Chambersburg hydraulic press used for hot-pressing and cold-

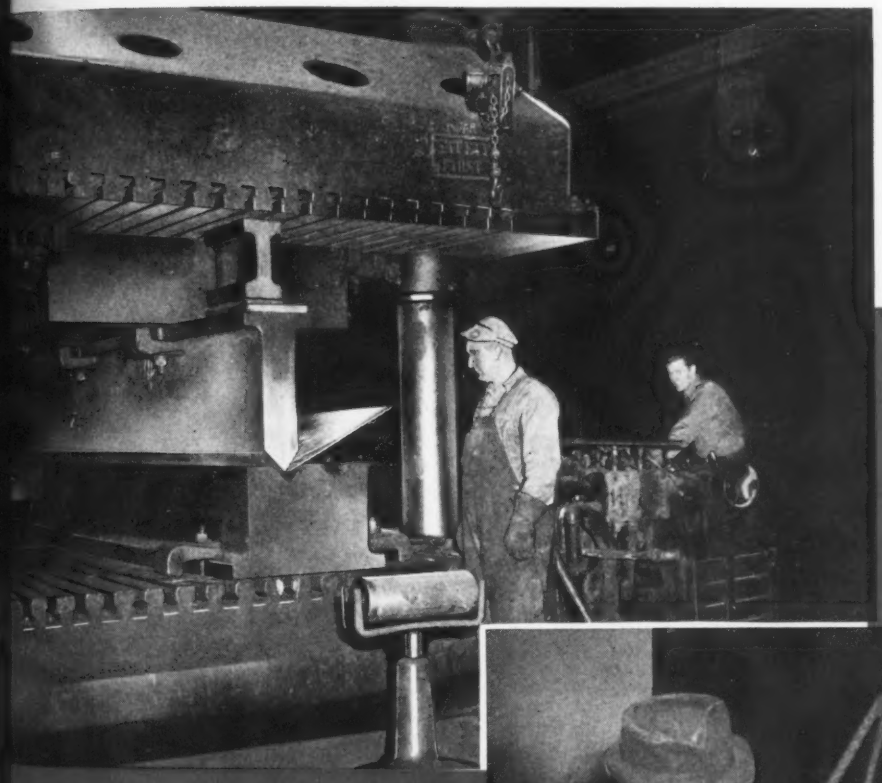


Fig. 8. (Left) Bending Scullery Plates on a 1000-ton Hydraulic Press in which the Bottom Platen Rises to Carry the Die to the Punch

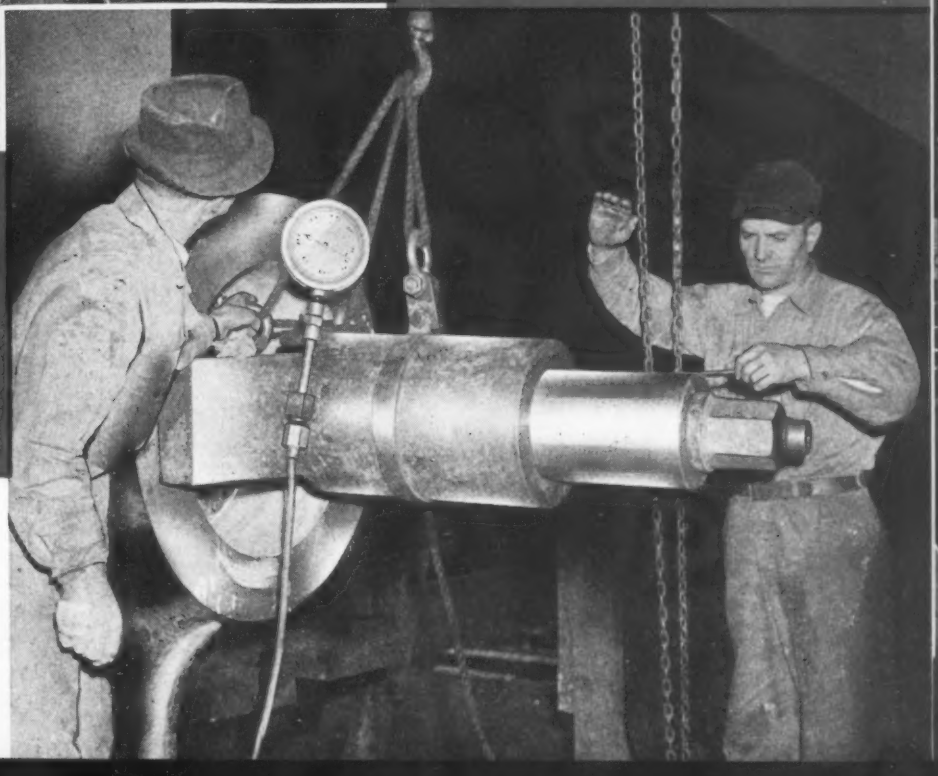


Fig. 9. (Right) Hydraulic Jack Used in Pulling the Stern Tube into the Stern-frame Eye

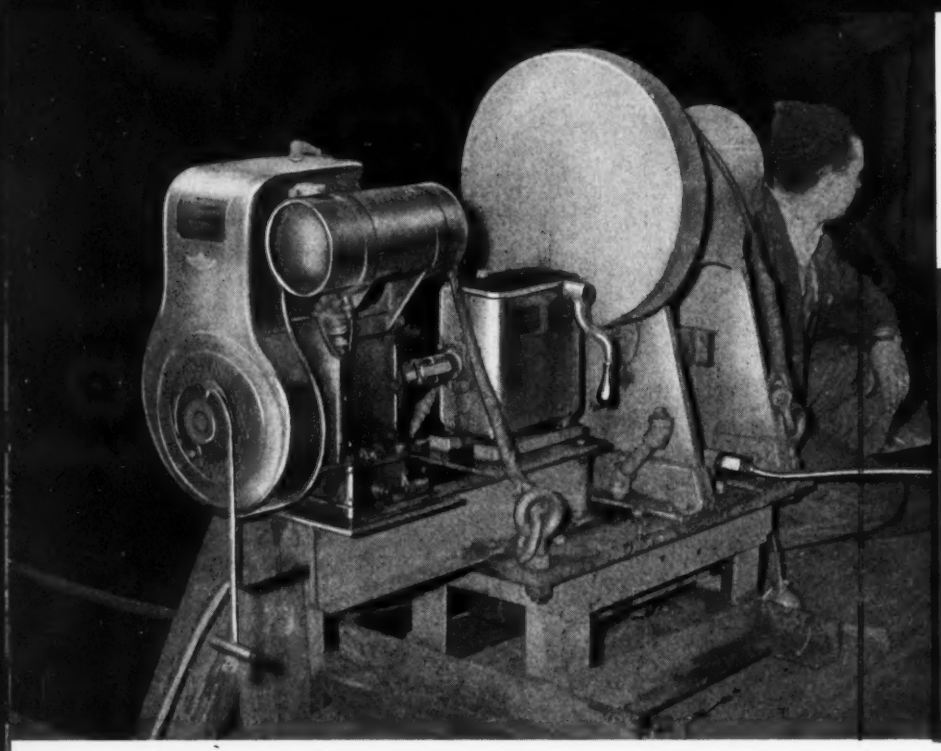
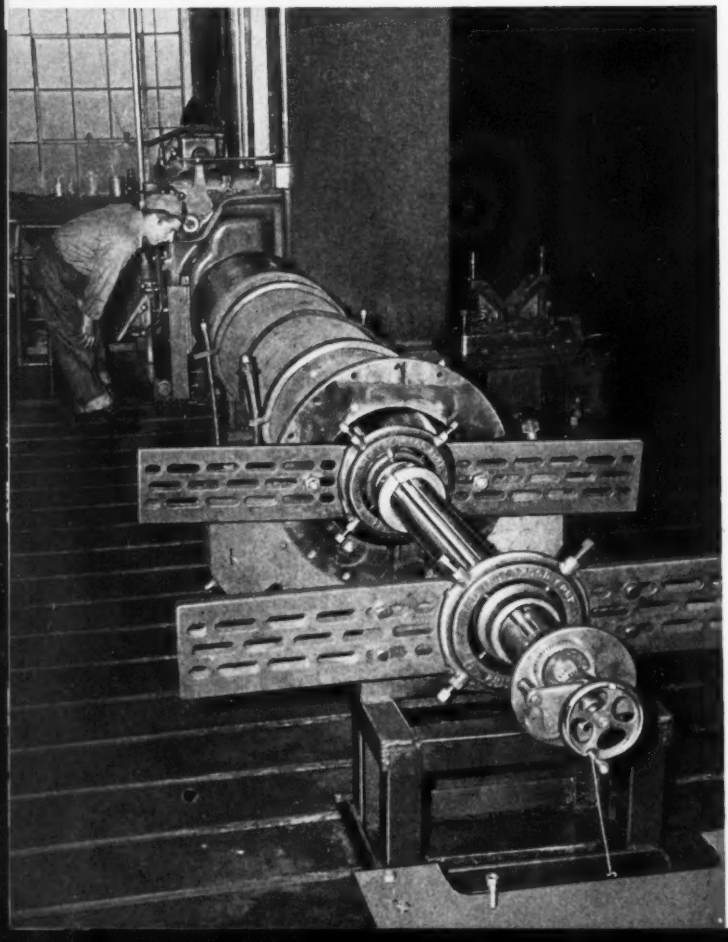


Fig. 10. (Left) Gasoline-engine Driven Two-cycle Reciprocating Pump which Supplies Fluid under Pressure to the Hydraulic Jack Illustrated in Fig. 9

Fig. 11. (Below) Horizontal Boring, Drilling and Milling Machine Set up with an Underwood Boring-bar for Finishing the Lignum Vitae Lining in One End of a Stern Tube

bending operations on steel plate. At the time that the photograph was taken this machine was engaged in bending scullery plates about 15 feet in length by 5/16 inch thick. It performs similar operations on plates for fuel-oil and settling tanks. Stern plates and boss plates are hot-pressed by using heavy dies. The platen is raised, in bending or hot-pressing, through the action of five hydraulic cylinders in a pit below the press.

At the shipyard the incoming fabricated sections, as well as all other equipment required for the vessels, such as engines, winches, ventilating ducts, chain, and so on, are temporarily stored in areas set aside for the individual ship parts. From these areas they are transferred in direct flow lines to the shipways as required. There is never any back-tracking of material, and hull sections or ship units are not permitted to remain in storage areas for any considerable length of time. Through efficient planning of these fabricating and work-handling systems the time from the laying of the keel to the launching of the ship has been reduced from 250 days to only 21 days. There are now 46,000 employes in the fabricating shop and shipyard, a considerable percentage of which are women.



One of the most recent time-saving developments in the shipyard is a hydraulic jack and gasoline-engine powered pumping unit for assembling stern tubes into the stern frame. With this equipment, a stern tube is pulled into place in from eight to ten minutes, whereas two hours and four more men were required by the method previously used. In preparing for this operation, the stern-frame bore or eye is finish-bored to a nominal diameter of 27.625 inches, and this dimension is accurately checked by means of inside micrometers. Then the stern tube is turned 0.025 inch larger in diameter than the eye, so as to necessitate a pulling force of between 50 and 75 tons in assembling.

In the assembly, the stern-tube eye is coated with white lead to facilitate the operation. The stern tube is then lined up with the eye on the inside of the vessel, and the hydraulic jack is brought against the finished boss of the eye, as

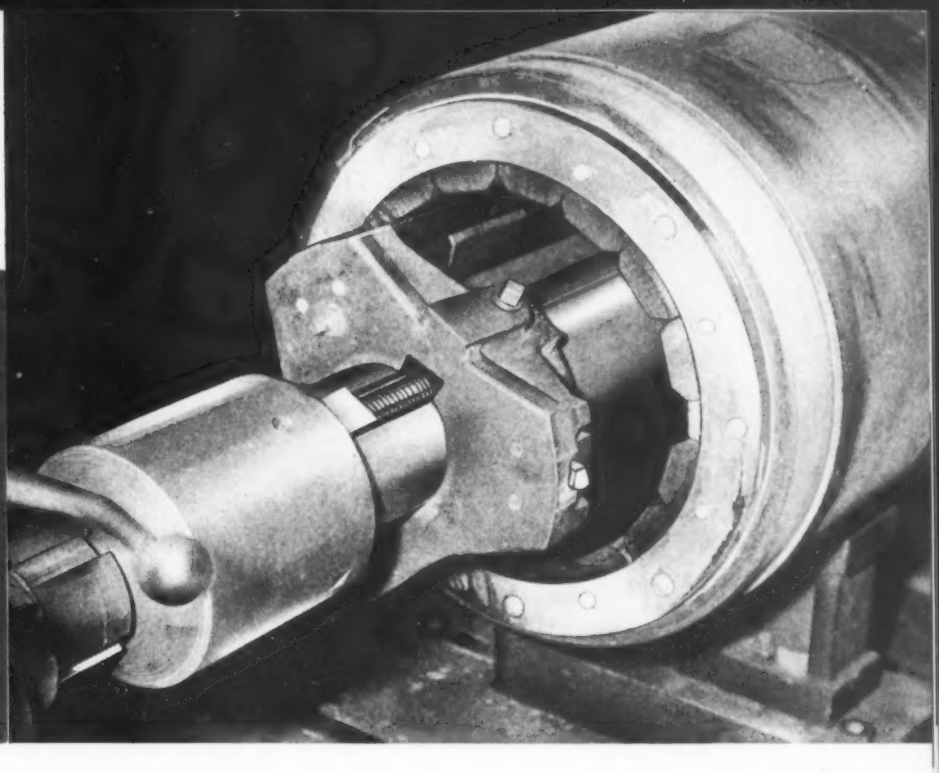


Fig. 12. Close-up View of the Stern-tube Boring Operation, Showing the Three-bladed Boring Head and the Lignum Vitae Lining of the Stern Tube

seen in Fig. 9. It is held in place by a long bolt 3 inches in diameter which extends through the eye and the stern tube to the first bulkhead. This bolt is blocked up so that it will be held central in the tube and eye. After the bolt has been inserted through the jack, a nut is screwed on and tightened by applying a large wrench. A heavy spider on the bolt is then clamped against the inner end of the stern tube. Then when hydraulic pressure is applied to the jack from the pumping unit, the jack piston is pushed aft, as seen in the illustration. The bolt is pulled with the piston and the stern tube is advanced into the eye by the pressure exerted by the spider.

After the full stroke of the jack piston has been attained, the pressure is released and the piston and spider are reset for a second application of pressure. This is necessary because the fit of the stern tube in the eye is 27 inches in length and the stroke of the jack is only 15 inches. It will be seen in the illustration that the piston is approaching the end of its stroke. The jack cylinder is 9 inches in diameter, and a pressure of from 2000 to 6000 pounds per square inch, as required, is developed in the cylinder.

A general view of the pumping equipment is shown in Fig. 10. It consists of a two-cycle reciprocating hydraulic pump, driven through reduction gearing from a one-cylinder gasoline engine. The pump was made completely from scrap parts. The hydraulic fluid under pressure is forced to the jack through 1/2-inch copper tubing. The pressure can be instantly varied to suit the progress of the stern tube assembly by turning a valve at the right-hand end. In the illustration, the attendant who operates the valve is seen watching for signals from the man in charge of the operation.

The stern tubes are lined at one end with strips of lignum vitae, 61 inches in length, which are sawed and filed by hand prior to assembly, in order to provide close fits, as indicated in Fig. 12. This illustration shows a stern tube set up on a floor plate in front of a Sellers boring, drilling, and milling machine, ready for boring the lignum vitae blocking. The operation is performed with an Underwood boring-bar, connected to the regular spindle of the machine for driving purposes. This bar is supported at the far end by two steadyrests, as shown in Fig. 11.

The boring head, which is seen in Fig. 12, is fed along the bar and through the stern tube by means of a lead-screw carried in a slot that extends the length of the bar on one side. The boring head is advanced 1/32 inch with each bar revolution, this movement being obtained by tying the feed-wheel seen at the end of the boring-bar in Fig. 11, by means of a wire, so that it cannot rotate with the boring-bar.

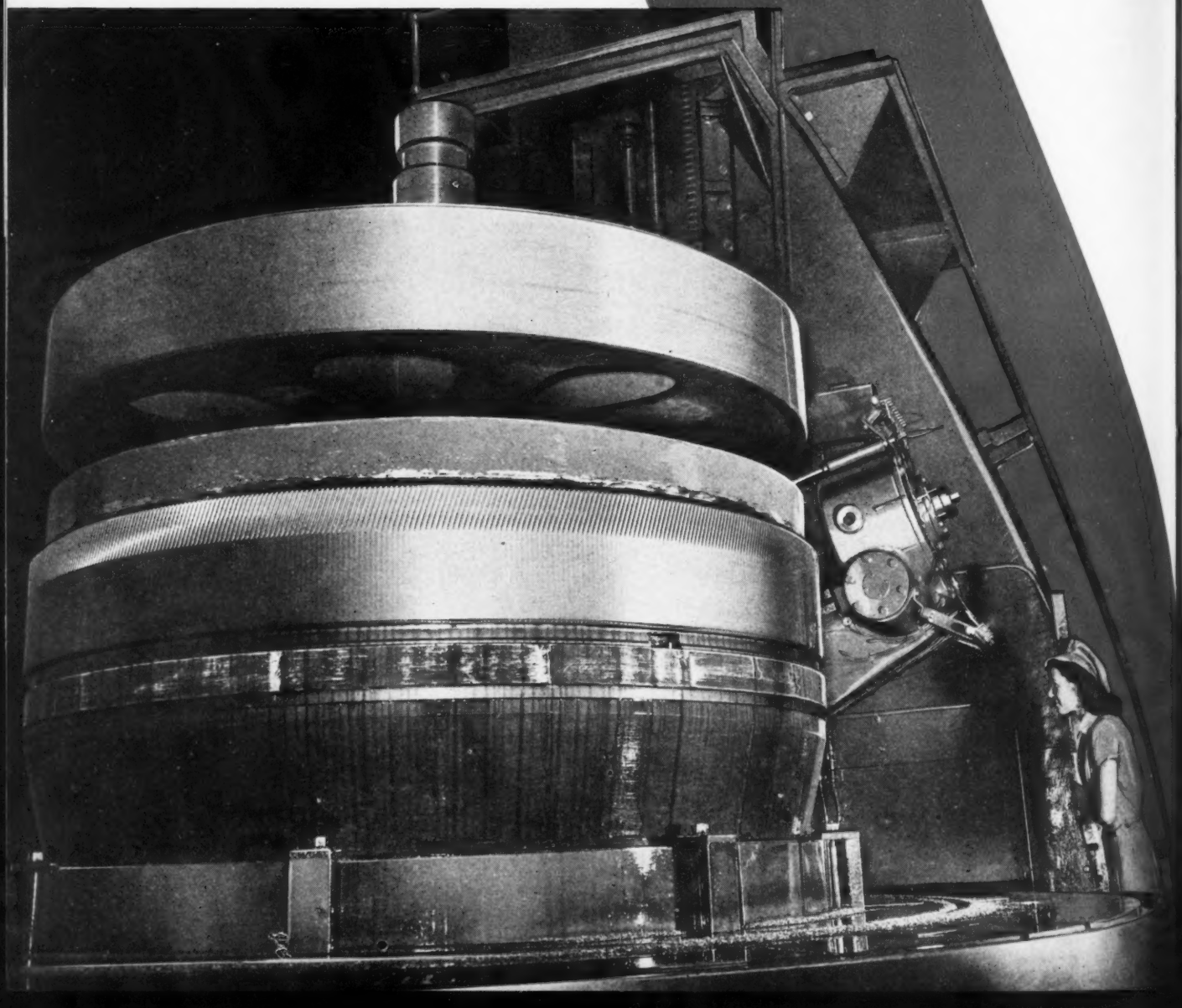
Only one pass of the boring head is required to bore the lignum vitae to the specified diameter, which is 0.045 inch larger than the propeller shaft. The boring head is fitted with two roughing cutters and one finishing cutter, all ground to a sharp rake to suit the machining of wood. This boring operation is now performed in 1 1/2 hours, including setting-up time, whereas it required half a day when the operation was performed in a lathe.

JOSHUA HENDY NOW *for Faster*

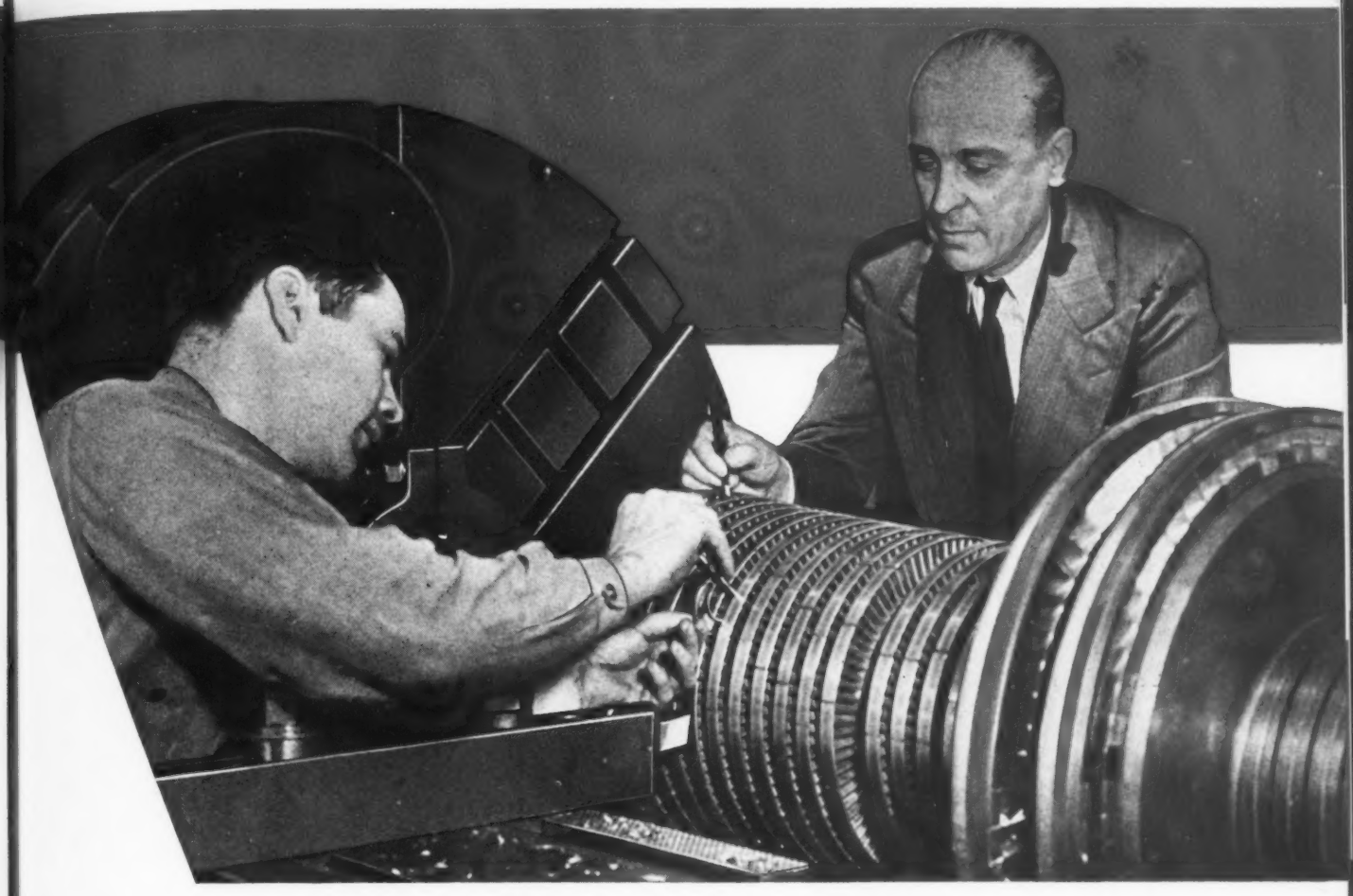
Pacific Coast Concern which Dates Back to the Gold Rush Days and which Achieved a Remarkable Record in Building Reciprocating Steam Engines for Liberty Ships has Turned to Turbines for the Faster C and Victory Ships

By GEORGE D. BOWMAN
Chief Tool Engineer, Joshua Hendy Iron Works

Fig. 1. Huge Hobbing Machine for Cutting the Teeth of Big Reduction Gears for Marine Turbines; Gears 15 Feet in Diameter can be Handled by This Equipment



MAKES TURBINES *Merchant Ships*

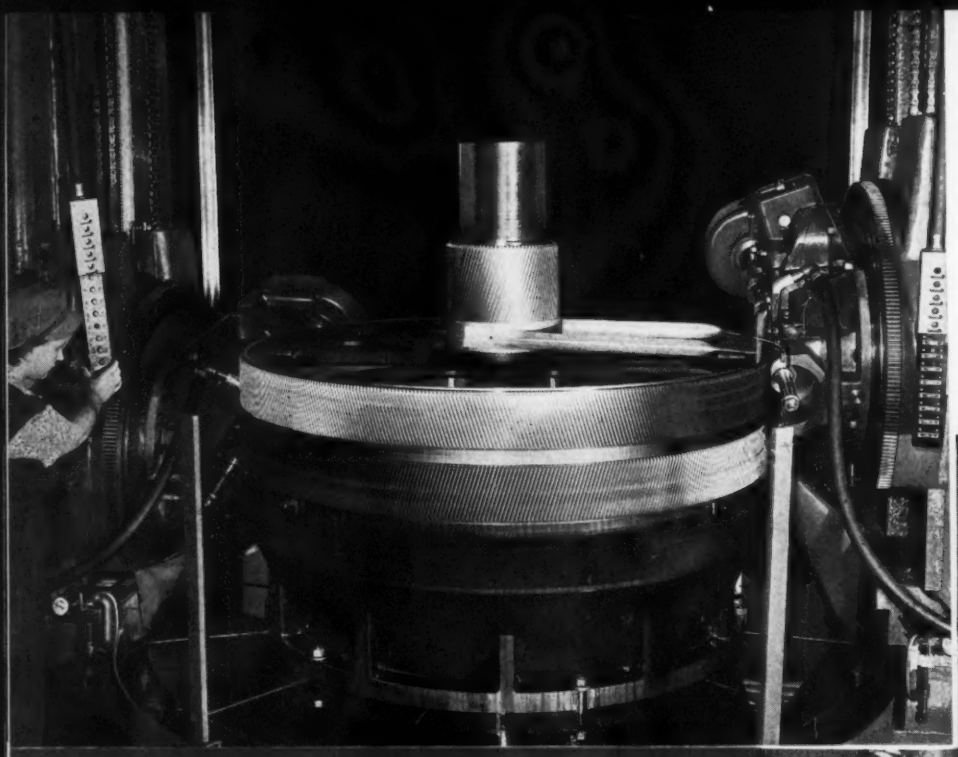


Workman Applying a Micrometer to Check the Diameter Shroud Strips on a High-pressure Spindle

SUNNYVALE, California, has become noted during the last three years as the home of the Joshua Hendy Iron Works, which achieved the amazing record of building one-third of all the triple-expansion reciprocating steam engines that drive the approximately 1600 Liberty ships afloat today. This record is the more remarkable when it is considered that the concern, starting with only 60 employes in 1940, now employs more than 7000 workers, recruited largely from farm-hands, fruit pickers, and clerks. In spite of the handicap of being able to hire only a comparatively small percentage of skilled workers, the concern became the country's largest builder of marine engines.

The reciprocating steam engines were turned out by the "Iron Men of Hendy" at the rate of thirty-five EC-2's and twenty naval frigate engines per month during the past year, which is an indication of the progressiveness of the management, because in the last war the concern required twenty-five months to build a total of eleven engines of similar type.

With the decision of the United States Maritime Commission to gradually change from the building of Liberty ships to the construction of the faster Victory ships as soon as industry could turn out turbines and Diesel engines in sufficient quantities, the Hendy concern was commissioned to add a turbine shop to its



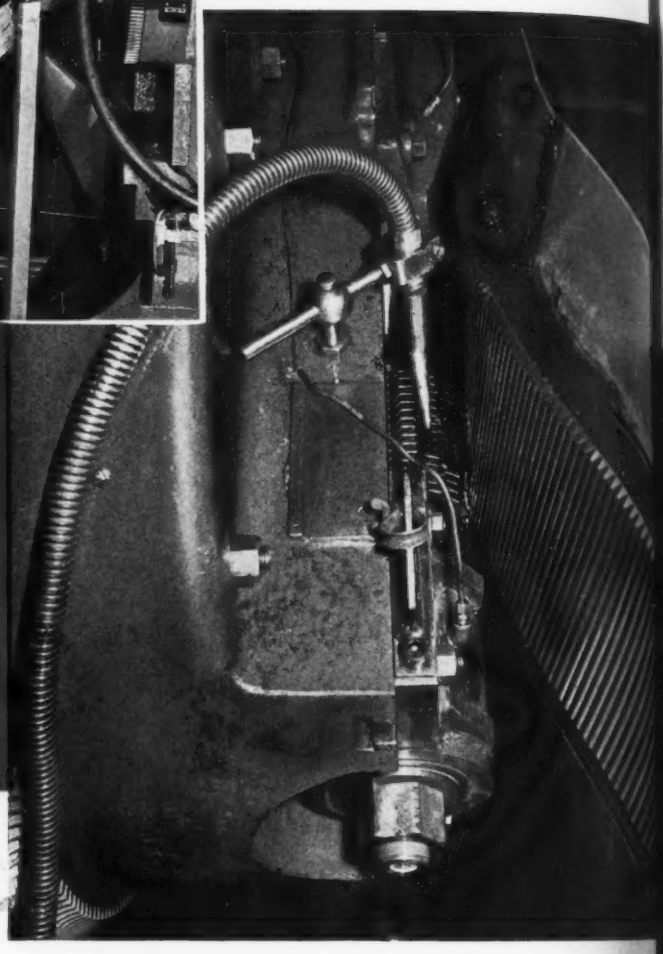


Fig. 2. (Above) Machines of Double-head Construction Enable the Right-hand and Left-hand Helical Teeth of Bull Gears to be Cut Simultaneously

Fig. 3. (Right) In Roughing the Turbine Bull Gears on the Machine Illustrated in Fig. 1, a Hob 6 Inches in Diameter is Used; It is Believed to be the Largest Hob Ever Used on This Type of Work

already expanded plant. This shop has produced a considerable number of 4000-H.P. turbines for driving C-1 cargo vessels. It is now starting on an order for 8500-H.P. turbines for C-3 passenger-cargo ships, and is tooling to commence work on 6000-H.P. turbines for propelling the new Victory ships. In addition, the shop is engaged in manufacturing 300-kilowatt turbines and reduction gear units for turbo-generator sets which supply power for lighting, pumping, driving winches, and other auxiliary-power purposes aboard ship.

To provide the necessary manufacturing facilities, this shop was equipped with the most modern machine tools obtainable, of which a considerable number are the largest of their type west of the Mississippi River, and some of them the biggest in the country. Fig. 1, for example, shows a Muir gear-hobbing machine which will accommodate gears up to 15 feet in diameter. This machine is seen engaged in rough-hobbing teeth of 6 normal diametral pitch on a bull gear 104.614 inches outside diameter for a C-1 turbine drive. The face width of each helix is 14 inches.

Gears of this type have 594 teeth, each of which must be so accurately cut that the pitch circle does not run out more than 0.0005 inch, and the helical angle of the teeth must be held to 0.001 inch per foot or less. Between the two helices, the thickness of teeth must not vary more than plus or minus 0.0005 inch. Such accuracy necessitates extreme caution while the tooth-cutting operations are in progress. Once

a cut has been started, the machine is never stopped until the operation has been completed. If the regular power supply should fail at any time, there is provision for immediately driving the machine from storage batteries.

After the teeth of the bottom gear of a set have been rough-hobbed to a left-hand helix, teeth are roughed out to a right-hand helix on the top gear. Then the teeth of both gears are finish-hobbed in succession. The procedure, however, varies with the type of gear being cut. Hobs 8 inches in diameter by 8 inches long are used in roughing, and they are believed to be the largest hobs ever employed on this type of work. A view of the roughing hob and the cutter-head is seen in Fig. 3. One cut is taken in rough-hobbing and one cut in finishing. A hob 3 3/4 inches in diameter by 4 1/4 inches long is used for the finishing cut. It takes eighteen days of twenty-four hours each for roughing and finishing both gears of a set on this machine.

In the rough-hobbing operation on teeth of 6 normal diametral pitch, the cut is taken to a depth of 0.385 inch, which leaves 0.016 inch of stock to be removed from the bottom of the teeth in finishing. Slightly more stock is taken from the sides of the teeth. The room in which this machine is installed is provided with air-conditioning equipment to insure that the temperature can be maintained closely during the complete cutting of both gears of a set.

One of the special features of this machine

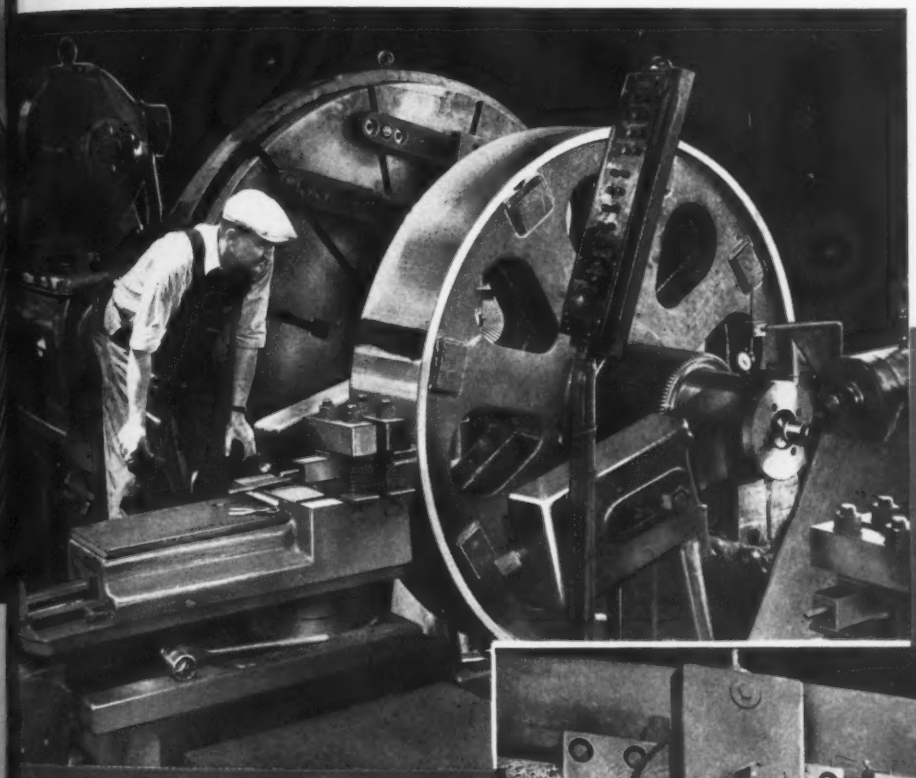


Fig. 4. (Left) Special Lathe of 200 Inches Swing Employed for Turning and Facing the Large Bull Gears. The Accuracy of the Rotation is Checked Constantly by Dial Indicators which Ride on the Gear-shaft

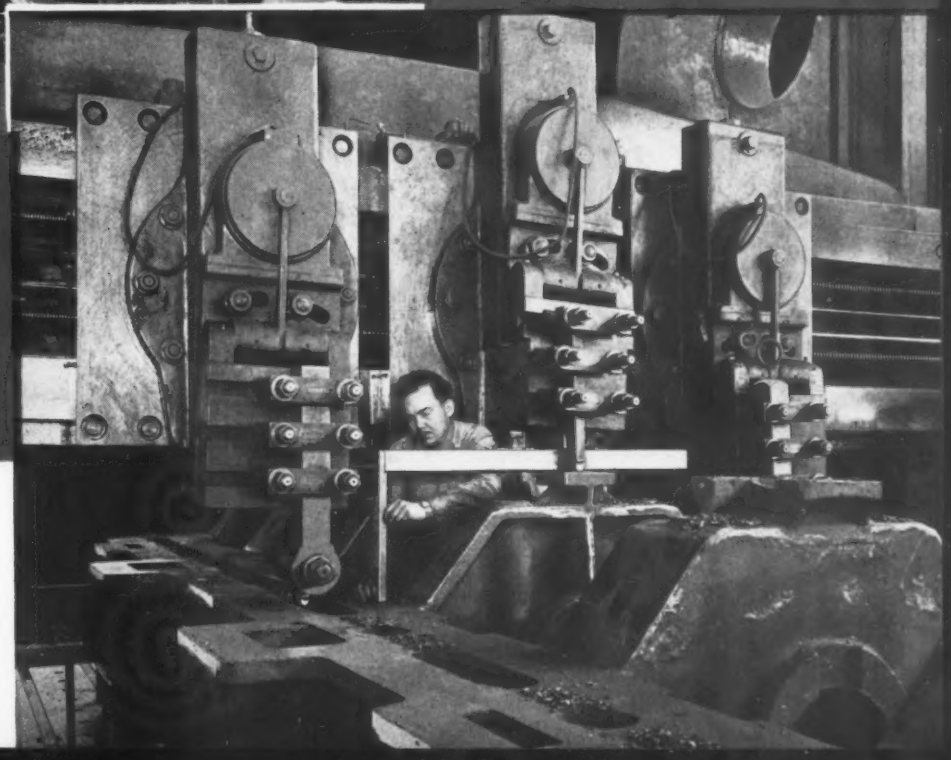


Fig. 5. (Right) Close-up View of the Huge Planer Shown in Fig. 7, Engaged in Machining a Bed for a Reciprocating Engine, although the Planer is Generally Employed on Turbine Work

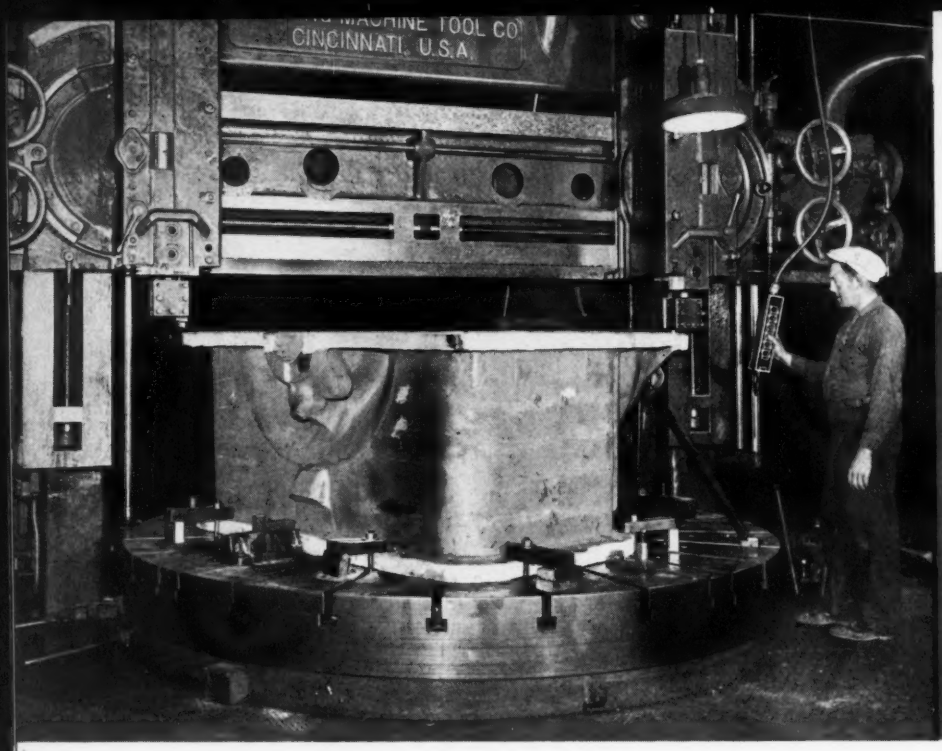


Fig. 6. (Left) Facing Lower Half of a Turbine Low-pressure Cylinder Casing on a Vertical Boring Mill of 120 Inches Swing

Fig. 7. (Below) Huge Planer Equipped with a Table 33 Feet Long by 15 Feet Wide which Weighs Approximately 48 Tons. This Heavy Weight is Carried on Four Flat Bed-ways

that is not generally available on gear-hobbers is a change-gear box that enables any prime number of teeth to be cut around a gear without providing special gears in the drive. The column of the machine is adjustable along the bed for varying the distance from the center of the work-table to the center of the hob-spindle. The height from the floor to the top of the column is approximately 20 feet.

An ingenious counterbalancing device relieves the table from the weight of the heavy fixture and the gear set being machined. These, together, sometimes weigh as much as 52,000 pounds. The counterbalancing device, which is built on the principle of a scale beam, reduces the actual weight on the bed-ways to less than the weight of the table itself. A brake band extending completely around the table eliminates any tendency to chatter.

Gears up to 160 inches in diameter can be cut considerably faster on a big Gould & Eberhardt double-head hobbing machine. This machine accommodates the bull gears for C-3 ship turbines, which are 147 inches in diameter. The 104.6-inch gears are rough- and finish-hobbed complete within nine days, this comparatively rapid time being possible by using two hobs simultaneously for cutting the two gears of a set in both roughing and finishing. The feed of one head is always in the opposite direction to that of the

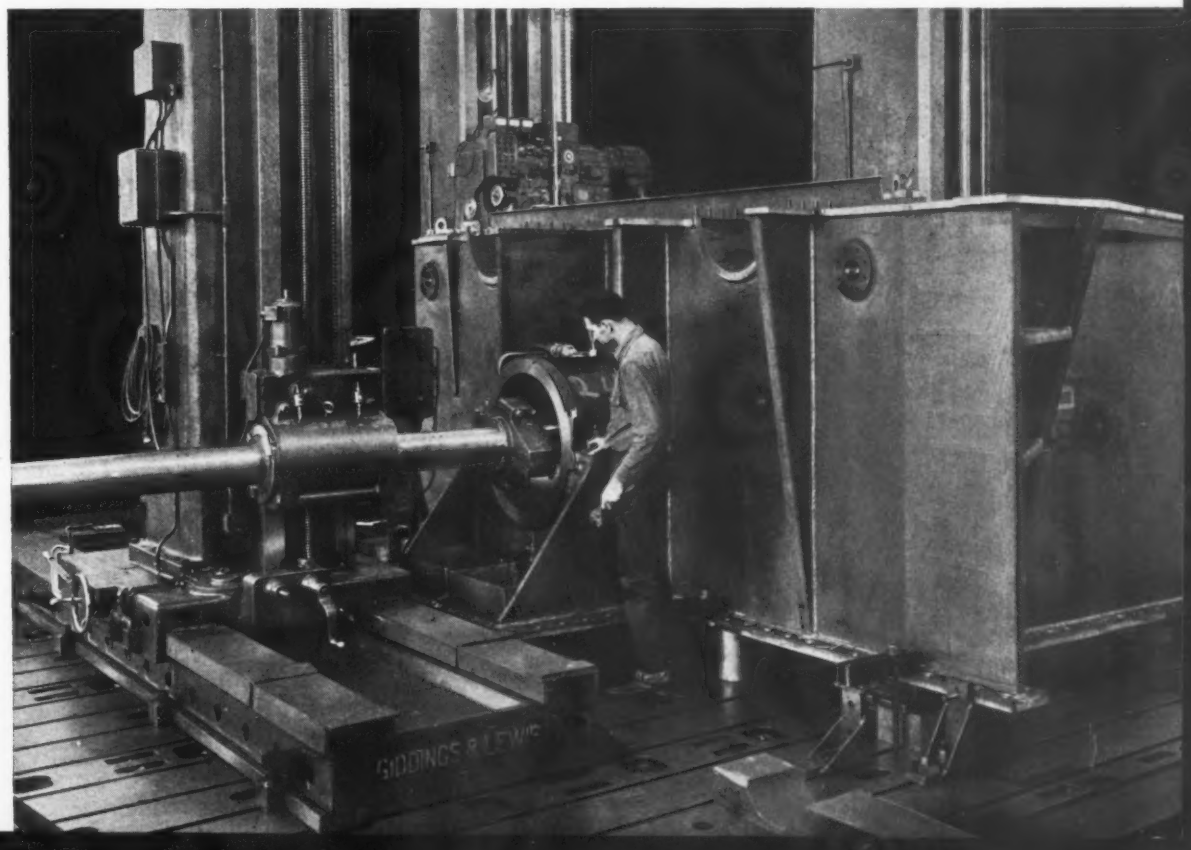
Fig. 8. (Right) Various Bores in Cylinder Castings are Machined Accurately in Line on a Horizontal Boring Mill

Fig. 9. (Below) Boring Gear Case for a C-1 Turbine on a Large Floor Type Boring Mill with an Outboard Column that can be Located as Required on a 20-foot Square Floor-plate

other, and may be toward or away from the center of the two gears. The table of this hobber runs on a tapered roller bearing of 62 inches outside diameter. Oil pressure provides sufficient lift to the work-table to compensate for the load of the work and fixture, thereby reducing the friction on the annular ways and also decreasing the load on the index worms and gears.

Another Gould & Eberhardt hobber of the same double-head design but of smaller capacity is seen in Fig. 2 engaged in cutting the helical teeth on gears approximately 75 inches in diameter. These teeth are of 7 normal diametral pitch, and there are 500 teeth around each gear. Hobs 4 inches in diameter by 4 inches long are used. These gears are roughed and finished in four days. Smaller machines of single-head design are used for producing the pinions that mesh with the bull gears of turbine drives.

Before the large bull gears arrive at the gear-hobbers, they are turned to the specified diameter within plus or minus 0.002 inch on the Fitchburg 200-inch single-purpose lathe illustrated in Fig. 4, and are also faced on the same machine. Two tool carriages at the front of the lathe provide for simultaneously turning both gears of a two-gear set. There is a third carriage at the rear which may be applied for taking additional cuts simultaneously, as for example, in



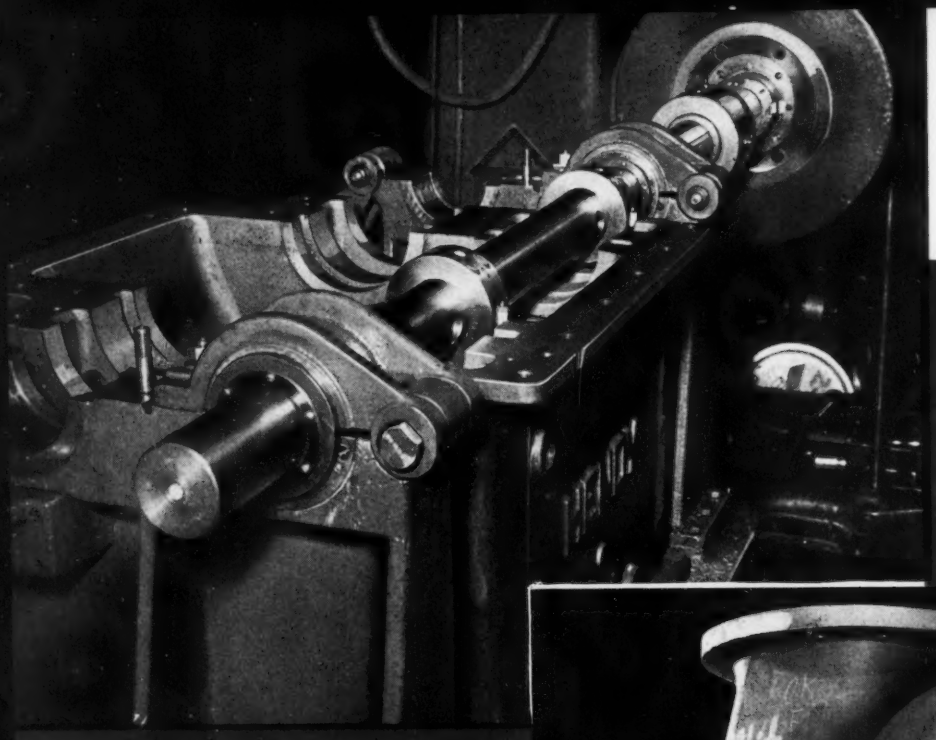


Fig. 10. (Left) The Shaft Bearings in Gear-cases for 300-kilowatt Turbines are Bored in Accurate Relation to Each Other by Means of a Work Fixture Designed for Positive Location of the Boring-bar

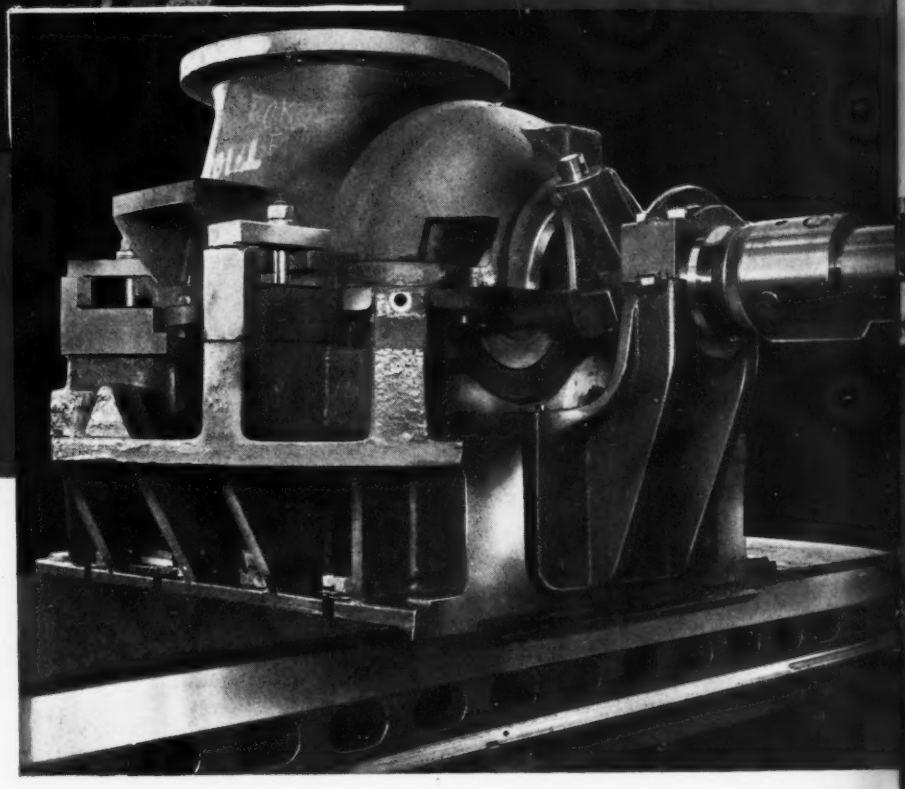


Fig. 11. (Right) The Cylinder Casing for 300-kilowatt Turbines is also Bored and Faced in a Fixture Designed for Accurate Location of the Tool-bar in Relation to the Work

taking facing cuts at the same time that the turning is being done.

Because of the heavy weight of the bull gears and their shafts, which is sometimes as much as 20,000 pounds, the gear-shafts are supported on steadyrests at each end during this lathe operation. Attached to the steadyrests are brackets which support dial indicators that ride on the gear-shaft during an operation to give a constant check of concentric rotation. The bull gears are fabricated by welding steel plates together.

A huge Craven planer ordinarily used for finishing large cylinders and casings for turbines is shown in Figs. 5 and 7. At the time that the photographs were taken the planer happened to be working on a heavy bed casting for a reciprocating steam engine. The table of this planer is 15 feet wide by 33 feet long, and weighs approximately 48 tons. This heavy weight is carried on four flat bed-ways, each about 8 inches wide. Castings up to 13 feet in height and 17 feet in width can be accommodated under the cross-rail. There are four tool-heads on the cross-rail, three of which are seen in use in Fig. 5. There are also side-heads on the two columns of the planer.

A gear-case for the turbine drive for a C-1 cargo vessel is seen being bored in Fig. 9 by a large Giddings & Lewis horizontal drilling, milling, and boring machine. This machine employs a 7-inch boring-bar. It is shown engaged in finishing a bore 26 1/2 inches in diameter by 17 1/8 inches deep. A facing cut is also taken

across the bottom of the bore and on the outside flange. On work of this type the bores are customarily held to the specified diameter within a total tolerance of 0.001 inch.

This boring mill is of the floor type, and is mounted along one side of a floor-plate approximately 20 feet square, which is large enough to accommodate the biggest work assigned to the machine. The outboard column is mounted on a bed that can be located anywhere on the floor-plate to suit the job by using an overhead crane.

A King vertical boring mill with a swing of 120 inches is shown in Fig. 6 employed in facing the lower half of the low-pressure cylinder casing for a C-1 turbine. Cuts up to 1/2 inch in depth are taken by the two rail-heads, the cuts being interrupted at several points around the casing due to the irregular contour of the flange. These casings are machined on both ends by the same machine.

In Fig. 8 a Fitchburg horizontal boring mill is being used for boring the complete low-pressure cylinder casing for a C-1 turbine. At the beginning of the operation, the shaft bearing at the opposite end of the casing to that seen is first bored to size, and a bronze bushing is then fitted into the bore for supporting the far end of the boring-bar during the rest of the operation.

The next step is to bore the shaft bearing at the near end of the casing, as shown, after which a series of circular surfaces on the inside of the casing are machined to diameters as large as 54

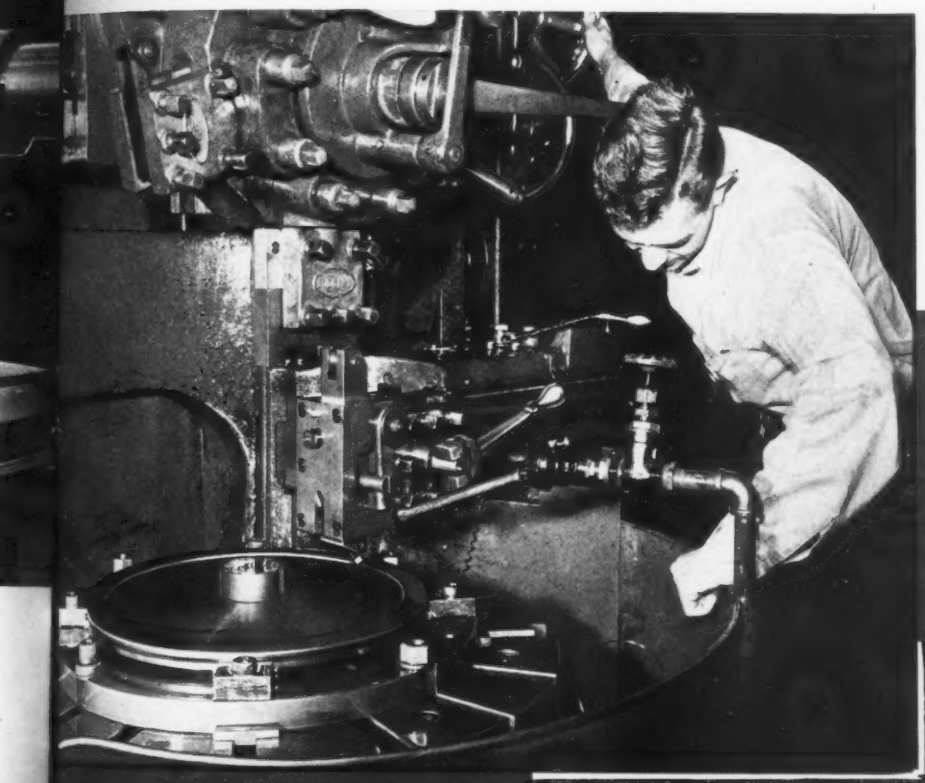


Fig. 12. (Left) Vertical Turret Lathe Set up for Facing a Wide Beveled Surface by Means of a Counterweighted Side-head, the Up and Down Movements of which are Controlled by a Cam on the Turret

Fig. 13. (Right) Large Inexpensive Welded Fixture Designed for Holding Generator Rocker-ring Brackets while being Machined to a Large Radius

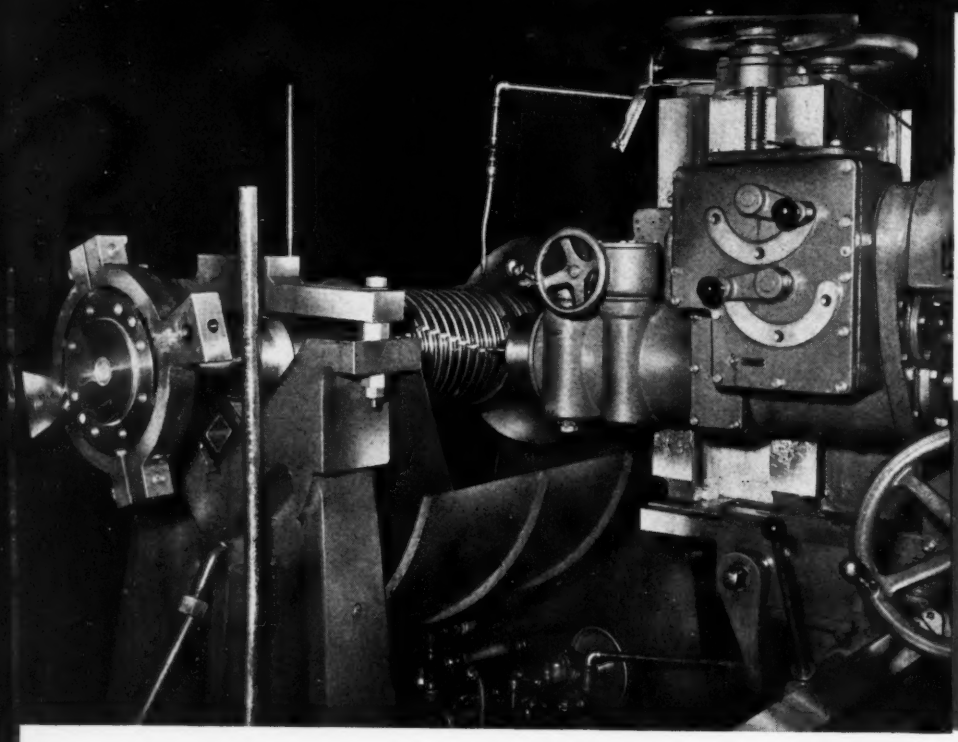


Fig. 14. Machine Employed for Cutting the Blade Locking Slots around High-pressure Turbine Spindles through the Use of an End-mill

inches. For these large-diameter boring cuts, the tools are mounted on large spider type heads fastened on the boring-bar. The boring-bar is 7 inches in diameter. Cuts are taken by feeding the bar through the work.

Gear-cases for the 300-kilowatt turbines are bored on a table type Giddings & Lewis boring, drilling, and milling machine equipped with a fixture that insures close maintenance of the center-to-center distance between the bores for two shafts. A view of this fixture is shown in Fig. 10. At the time that the photograph was taken, one-half of the casing had been removed to give a view of the boring-bar and cutters. When the operation is in progress, the top half of the casing is also in place so that all bearings are machined around a complete circle.

All the bearings for either of the two shafts are bored simultaneously and accurately in line, due to the fact that the boring-bar is held in bushings that are locked in bearings on the fixture. When the bearings for one shaft have been finished, the boring-bar with its bushings is transferred to the other locating bearings of the fixture, which line it up automatically for machining the bearings for the second shaft of the turbine casing. The drive from the spindle of the boring mill to the boring-bar is transmitted through a universal coupling which compensates for any minor misalignment between the bar and the spindle. Thus, the accuracy of the operation depends entirely upon the fixture, rather than upon the care taken by the operator in adjusting the positions of the work-table and the boring spindle.

In this operation, the casing bores are finished to nominal diameters of 6 and 7 inches within a tolerance of plus or minus 0.001 inch. The cutter-bar is run at 44 R.P.M. and fed at the rate of 0.012 inch per revolution. Tungsten-carbide tipped tools are employed.

In Fig. 11, the bottom half of a cylinder casing for a 300-kilowatt turbine is being faced while mounted in a fixture that is also designed for holding the long boring-bar accurately in line with the work. The facing cut is taken by a tool held in a bar that is fed outward with each revolution through the action of a star feed.

More important than the facing cut, however, are the boring and turning cuts taken in the same set-up. An inside bore is finished to 23 inches diameter for a length of approximately 12 inches within plus 0.002 inch, minus nothing. In addition, a shoulder is accurately turned between the two surfaces seen being faced. The connection between the tool-bar and the machine spindle, in this case also, is through a universal coupling.

A Bullard vertical turret lathe tooled up for a series of tapered and straight facing cuts and turning and boring cuts is illustrated in Fig. 12. The operation is performed on single-row action wheels to which turbine blades are later assembled. The wheels are carbon-steel forgings. The sides of these wheels are tapered from the flat face around the rim to the central hub.

The tapered surface on either side is machined by feeding the side-head across the work under the control of a cam mounted on one of the turret faces, as illustrated. A counterweight

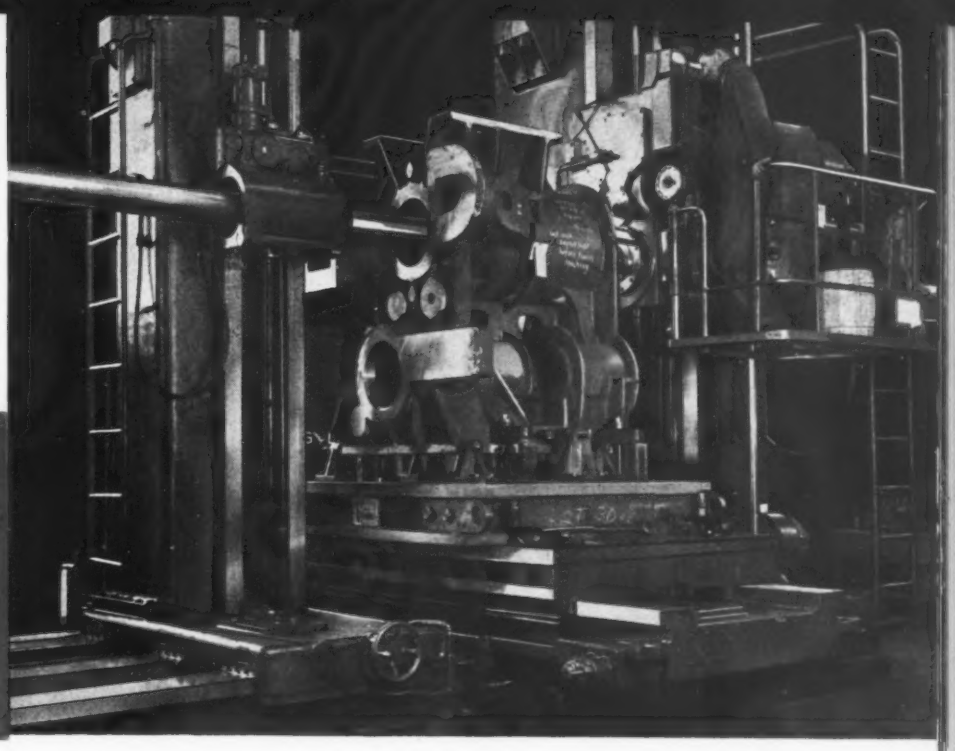


Fig. 15. Idle Time has been Practically Eliminated by Lining up Reciprocating-engine Parts on Set-up Plates before Taking Them to the Machines

connected to the side-head keeps a roller mounted on the tool-head in contact with the cam, so that the side-head moves up or down as the roller is moved across the cam. A carbide-tipped tool is used in facing. The flat side surface near the outside of the wheel is also faced in this operation, and the hub is faced to length. In addition, the upper half of the wheel rim is turned.

This is the second operation on the action wheel, the opposite side having been finished in a similar set-up, except that the groove for the turbine blades was also roughed out in the first operation. This groove is later finished on a lathe.

In Fig. 13 is shown a special fixture devised for machining generator rocker-ring brackets to a large radius on another Bullard vertical turret lathe. Twelve brackets are mounted around the large circular fixture at one time. A recess is turned in each bracket to a depth of 3/16 inch for a width of 3 inches. Two tools are used in the turret, one for cutting away most of the stock from the recesses, and the other for turning square corners at the top and bottom of the recesses.

A machine built by the Fitchburg Engineering Corporation for milling blade locking slots on high-pressure spindles is illustrated in Fig. 14. These slots are laid out in staggered relation to each other around the spindle before the latter is brought to the machine. The spindle is supported in heavy vees, and is turned in these bearings to bring each slot to the proper height with respect to the 3/8-inch end-mill that takes the cut. The cutter-head is mounted on a heavy carriage, which is moved along the machine bed to line up the end-mill for cutting through the successive blade "rings." The carriage is also fed during the actual milling of each slot.

The high output of the reciprocating-engine shop was attained through the adoption of unusual mass production methods. One practice that facilitates accurate machining of large castings and permits almost continuous running of expensive machine tools is to set up the castings accurately on large plates before they are delivered to the machine tool. These plates are constructed to be mounted in a fixed position on the table of the particular machines on which operations are to be performed. The castings are set up on these plates in a separate department at one end of the shop by skilled machinists, and laid out ready for transfer to a machine as soon as the job on that machine has been completed. Thus, machine tools are idle only during the short time required to remove a set-up plate holding a finished part and substitute another set-up plate with a rough casting. In fact, due to the use of these set-up plates, large machine tools are actually running over 96 per cent of the time.

A typical operation is shown in Fig. 15 in which a high-pressure cylinder for a Vickers engine is being machined in the piston and valve bores. Flanges on the outside of the casting are also faced. The casting is mounted on a typical set-up plate about 5 feet square by 8 inches high. Links attached to the plate are provided with large holes to facilitate handling the loaded plate with an overhead crane.

CONSOLIDATED STEEL

War and Peacetime

Unusual Methods Developed to Meet Production Problems in a Pacific Coast Yard that has Gained Recognition for Versatility in Building Many Types of Ships

WAR contracts totalling more than a billion dollars have given the Consolidated Steel Corporation, Ltd., an eminent position among the nation's shipbuilding companies. Ships of many different types have been constructed in Consolidated yards—more types, it is believed, than have been built by any other similar company. These ships include C-1 cargo and passenger ships, destroyers, destroyer escort vessels, mechanized landing craft, frigates, barges, transports, and hospital ships. Work has recently been started on a num-

BUILDS *Craft*

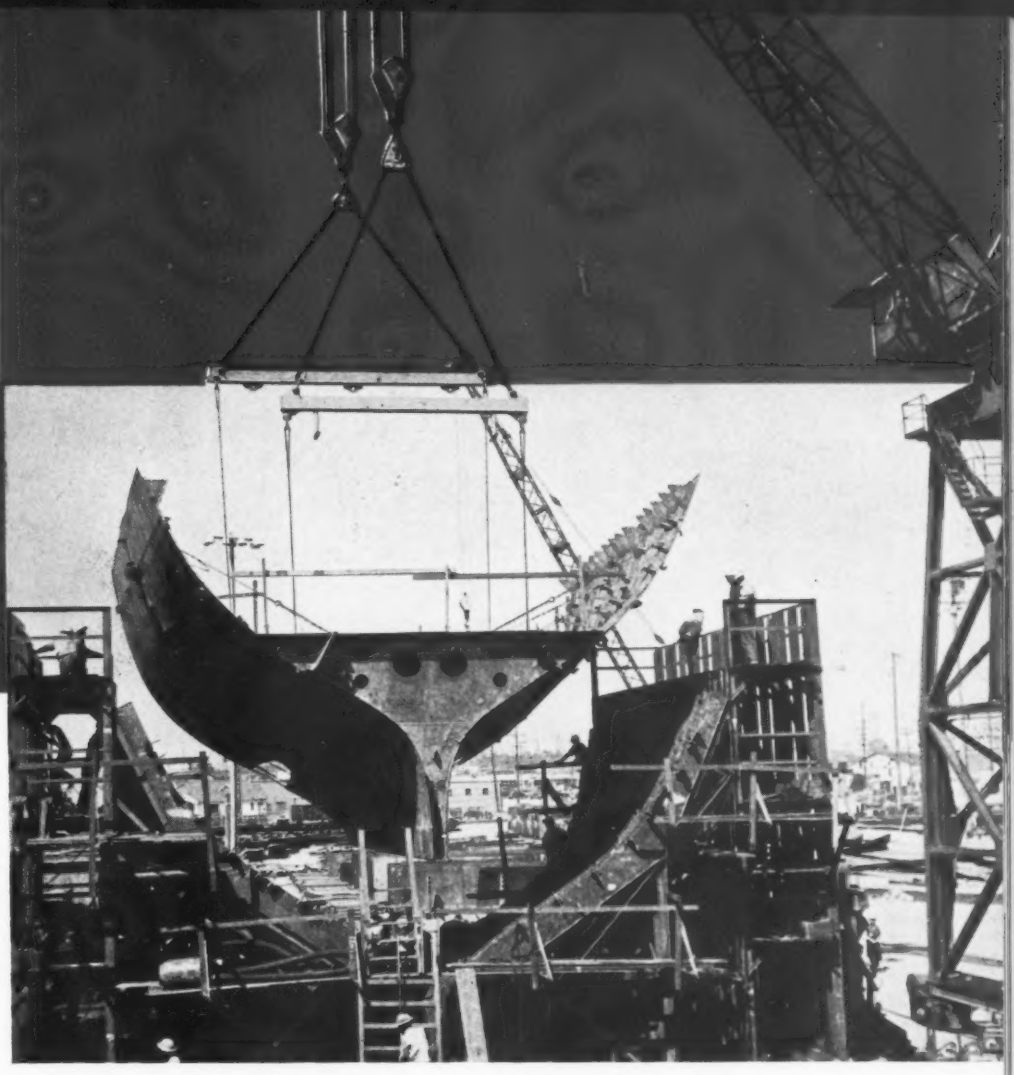


Fig. 1. Lifting an Aft Section of a Frigate from the Jig in which It was Sub-assembled, Ready for Transfer to a Shipway to be Welded into a Complete Hull

ber of combat transports of an entirely new design for the United States Maritime Commission and the United States Navy. Up until November first of this year, a grand total of 479 vessels had been launched from Consolidated ways—a remarkable record for a period of only two and one-third years.

The manufacturing facilities of this company consist of a steel fabricating plant and three shipyards in the environs of Los Angeles, and a fourth shipyard and a steel fabricating subsidiary in Texas. Vessels of large tonnage, such as the C-1 cargo ships, are constructed at the 95-acre Wilmington yard, and the combat transports will be built there. This yard, however, also has several ways for the construction of frigates, which are fast, light versions of a destroyer designed especially for anti-submarine warfare.

Plates and shapes for ships built on the Wilmington ways are sheared, punched, torch-cut, and sub-assembled by welding in fabricating shops of the Maywood plant, and transported several miles by truck to the shipyard for building into larger assemblies and complete vessels. Most of the sub-assembly work at the shipyard is performed outdoors in an area directly in line with and adjacent to the shipways.

Frigate sections are assembled in large jigs built up of structural shapes, and are transferred to the ways by jib cranes or truck-drawn dollies. The jigs insure interchangeability of large ship sections, such as the aft section seen in Fig. 1 being lifted from its jig. This section weighs approximately 30 tons. Sections such as this are welded together on the shipways to form the entire hull of a vessel. Tanks, fore peaks, aft peak sections, and inner bottoms for C type vessels are also fabricated in jigs.

Each jig is provided with a water level gage which is connected to a water system that holds the water at a predetermined height with respect to graduations on the gage. The height of reference lines on various vertical members of the jig can be readily checked by simply attaching a hose to the water system and extending the hose to the respective reference lines, since the water will overflow from the open hose end at the exact height of the gage reading. Adjustments can then be made to insure jig accuracy.

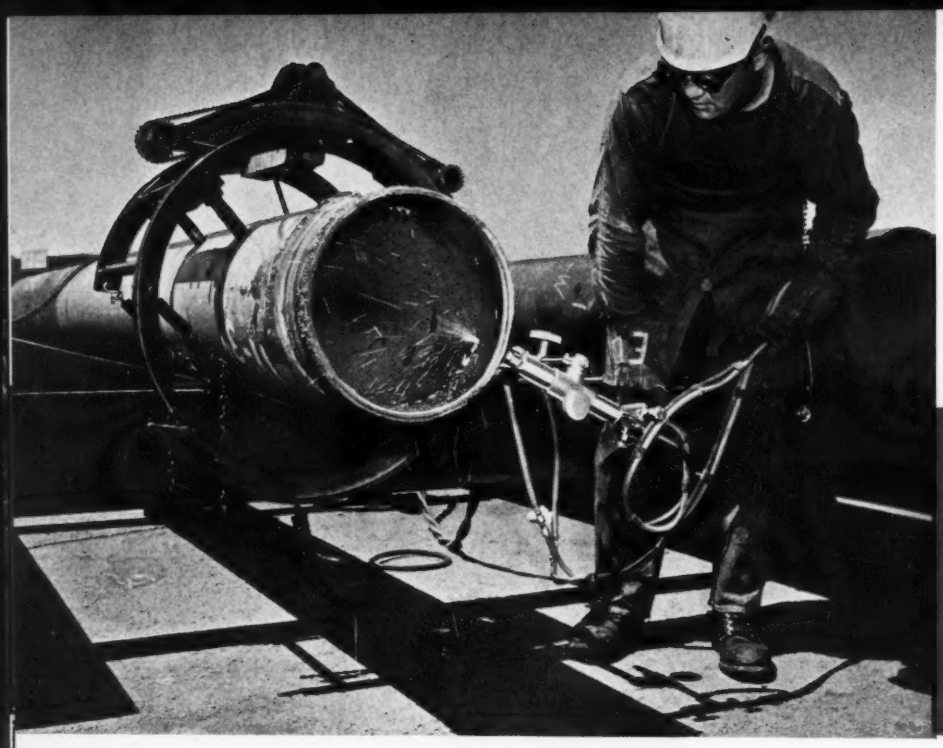


Fig. 2. Portable Oxy-acetylene Pipe-cutting Machine which can be Employed for Both Right-angle or Angular Cutting, the Torch being Revolved around the Pipe

Quite a few operations around the shipyard involve the use of equipment devised to meet special needs. For example, Fig. 2 shows an oxy-acetylene machine designed for cutting pipe either at a true right angle to the axis or at an angle to receive electrode deposit in welding operations. The oxy-acetylene head is mounted on a large gear segment, as may also be seen in Fig. 3, which revolves completely around a circular track that is clamped in a stationary position on the pipe being cut. This circular track is not a complete circle, having an open space larger than the diameter of the pipe so that the track can be slipped over the pipe. The gear segment is long enough to span the gap.

After the outfit has been set up on a pipe and the oxy-acetylene torch properly adjusted, the gear segment, with the cutting head, is driven around the track at any desired speed by the operation of a rheostat-controlled motor of 1/4 H.P. The drive from the motor to the gear segment is through reduction gearing and two pinions. Several sizes of this machine have been built to accommodate pipe of different diameters.

Equipment developed for performing rough-boring and facing operations outdoors on stern-frame castings is illustrated in Fig. 4. The rough-boring operation is performed on the stern-tube fit by employing a large boring-bar that is driven by a pneumatic drill in the manner shown, although a facing operation was actually in progress when the photograph was taken. Power is transmitted from the pneumatic drill to the boring-bar through reduction gear-

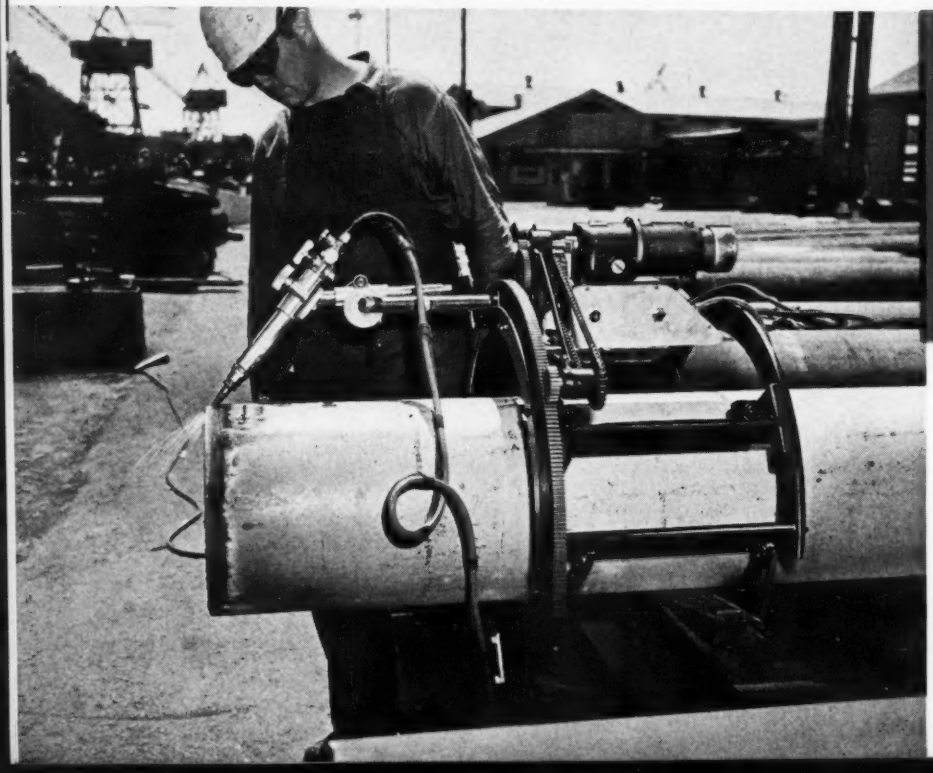


Fig. 3. Another View of the Pipe-cutting Machine Seen in Fig. 2, Showing the Driving Arrangement and Illustrating the Adjustability of the Cutting Torch

Fig. 4. Facing a Stern-frame Casting by Employing a Portable Machine Driven from a Pneumatic Drill which is also Used for Rough-boring the Stern-tube Fit

ing, which cuts down the drill speed of about 100 R.P.M. to 2 1/2 R.P.M. of the boring-bar. Steadyrests bolted to both ends of the stern frame provide adequate support for the tool-bar.

In boring operations, the boring head is fed through the stern frame by the indexing of a star-wheel, which actuates a lead-screw connected to the boring head a prescribed amount for each revolution of the bar. A star-feed is also used in taking the facing cut.

Finish-boring of the stern-tube fit is performed after the stern frame has been installed on the ship and after all welding and riveting on the aft section of the hull have been completed. Thus, the operation is not performed until all possible distortion of the hull due to welding and riveting has taken place.

The finish-boring is performed with portable equipment such as illustrated in Fig. 5, which is bolted to brackets tack-welded to the under side of the ship. The boring-bar is accurately aligned for the operation with a steel wire that is extended horizontally from the lineshaft bearings in the engine room. In actual boring, the head is advanced through the stern-tube fit by the action of a star-feed. This unit also is driven by a pneumatic drill, as seen at the left-hand end of the illustration, which transmits its power through reduction gearing to one end of the boring-bar.

The accuracy of this boring operation can be realized from the fact that although the lineshaft of a C-1 ship weighs between 40 and 50 tons, it is so well balanced when installed that

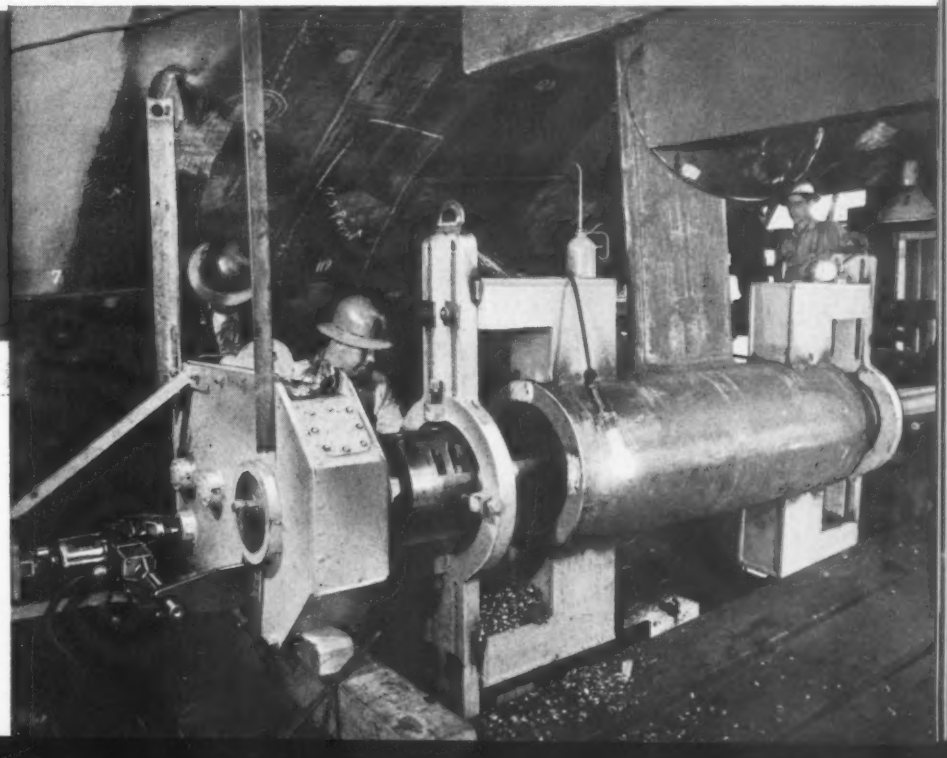


Fig. 5. The Stern-tube Fit is Finish-bored after Stern Frame has been Installed on a Vessel and All Welding and Riveting on Aft Section of Ship have been Completed

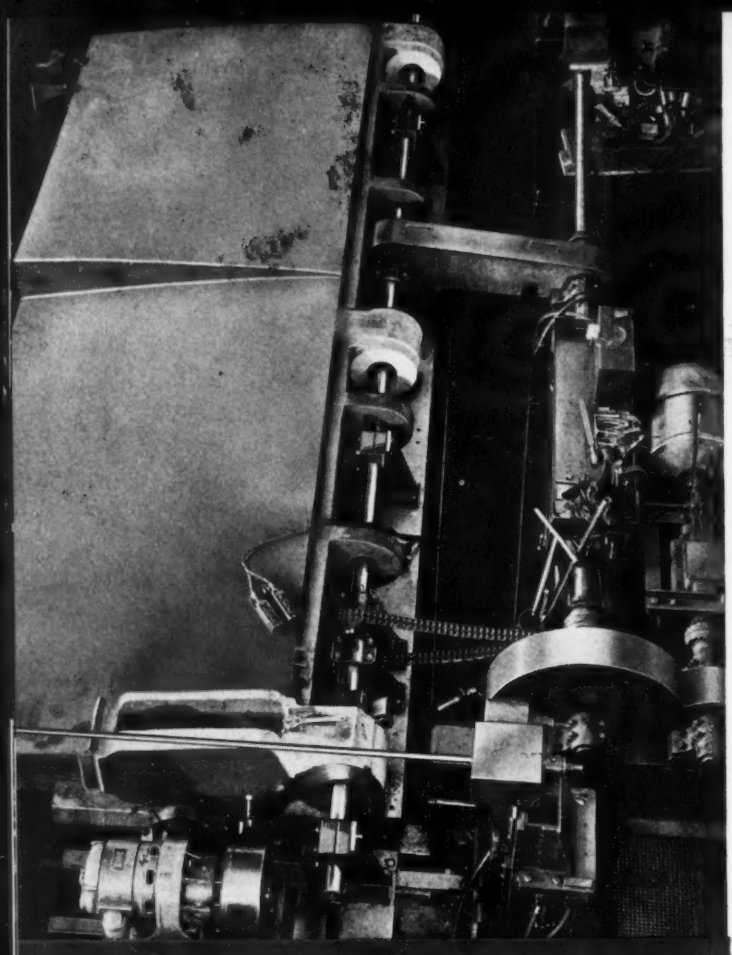


Fig. 6. General View of Two Special Machines Developed for Performing Operations on Large Rudder Castings

it can be turned over with the propeller by one man. The stern-tube fit must be finished to the specified diameter within 0.002 inch. The illustration shows an operation being performed on the stern frame of a frigate, frigates being equipped with two propellers.

In Fig. 7 is shown a LeBlond lathe of 68 inches swing being used for turning a propeller shaft for a C-1 cargo ship. The shaft is turned the entire length to diameters that are held to size within 0.005 inch. The taper fit being finished at the time that the photograph was taken must be true within a closer tolerance, however, and this fit is checked by coating with Prussian blue and setting gages on it. Threads are cut at one end to a diameter of 11 inches, four threads per inch of U. S. Standard form. A bronze bushing 16 feet 6 inches in length which had been shrunk on this shaft after it had been turned is also machined in this lathe. The lathe has a bed 50 feet in length.

Several special machines have been designed for operations on large rudder castings. These machines are so grouped that they can all be applied on a rudder after it has once been set up. Two of them can be seen in Fig. 6. The machine seen extending along the right bores all three gudgeons and several holes in shorter bosses simultaneously. These boring cuts are taken by tools held in slots that extend through the boring-bar. The bar is fed lengthwise to carry the cutters through the bosses through the action of a separate unit not seen in the illustration.

Facing heads of a split design are mounted on the boring-bar upon the completion of the boring cuts for taking facing cuts across the

Fig. 7. Taper-turning the Propeller Fit on a Long Propeller Shaft after the Straight Sections have been Turned and Thread Cut

various bosses. A close-up view of one of these facing heads is shown in Fig. 8. Wide-faced cutter blades mounted on this head enable the operation to be performed without any radial movement of the blades. There is also a tool-head of a clapper-box design, which is used for machining clearance in back of one of the gudgeon bosses.

Another boring-bar is employed to cut a taper in each gudgeon hole. This bar is equipped with a tool-holder mounted on a slide that moves along a tapered bar. As the tool-holder is fed along the slide by a lead-screw, the tool is automatically fed radially for finishing the bore to the specified taper.

At the end of the rudder seen in the foreground in Fig. 6, there is a separate machine with a carriage that is fed along a bed to carry either face-milling cutters or a fly cutter across the casting, as seen in Fig. 9. When equipped with a small-diameter face mill, this machine is also used for cutting a keyway across the end of the casting.

Operations in the building of ships in this shipyard have been speeded up greatly by establishing standard operation times for every production job. Some of the results obtained through this practice have been startling. Investigations showed, for instance, that riveters were frequently held up by not having sufficient work to keep them busy, and that they frequently lacked adequate supervision. By correcting such deficiencies, the cost of riveting has been reduced to one-third of the original cost per rivet. The establishment of standard procedures has also been very effective on all other operations.

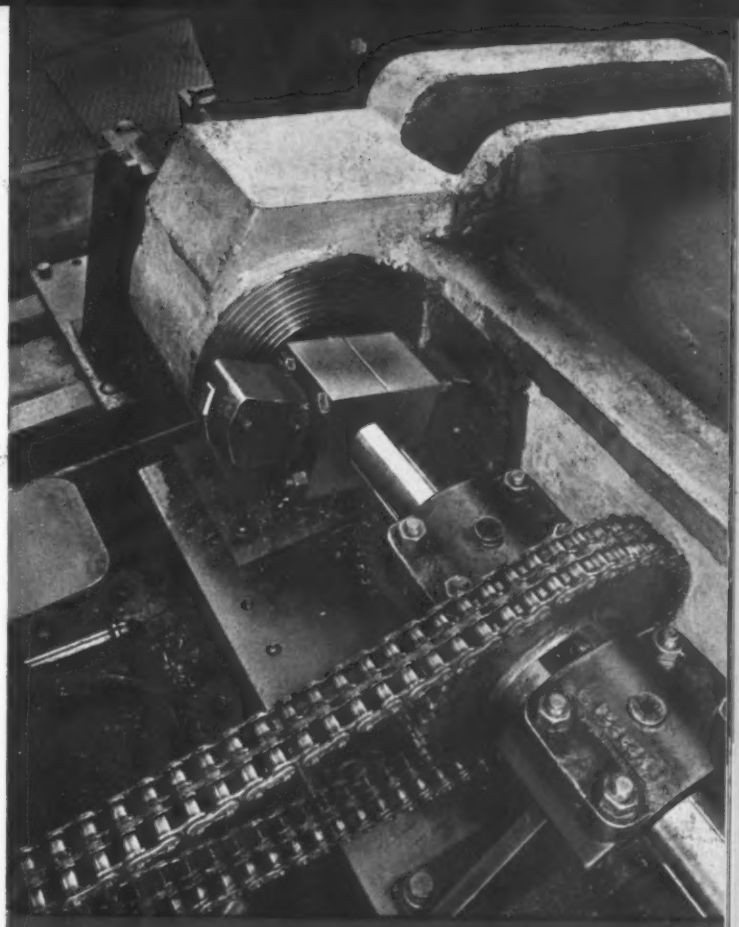


Fig. 8. Close-up View of a Facing Head of Split Design, Employed for Facing Gudgeons on Rudder Castings

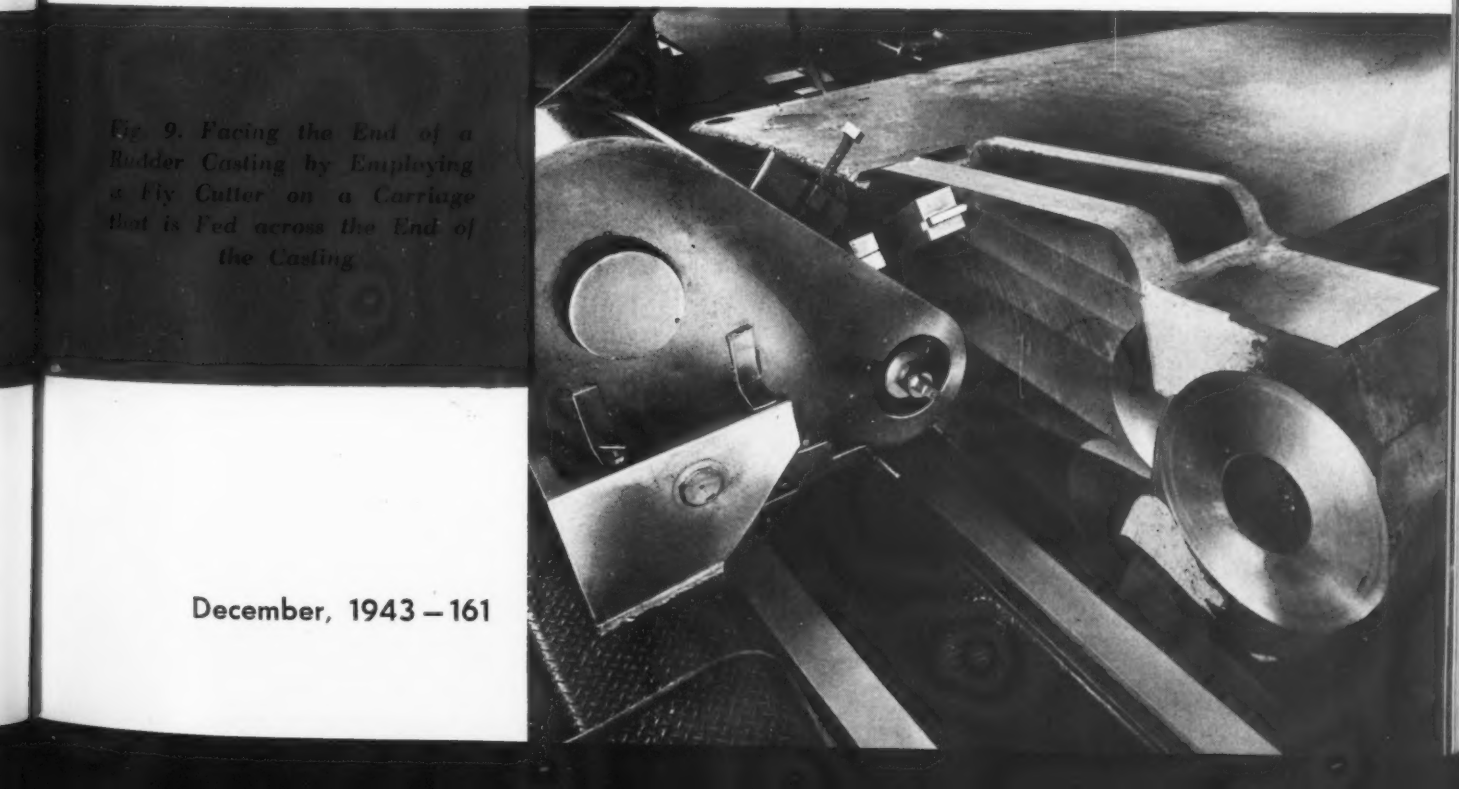
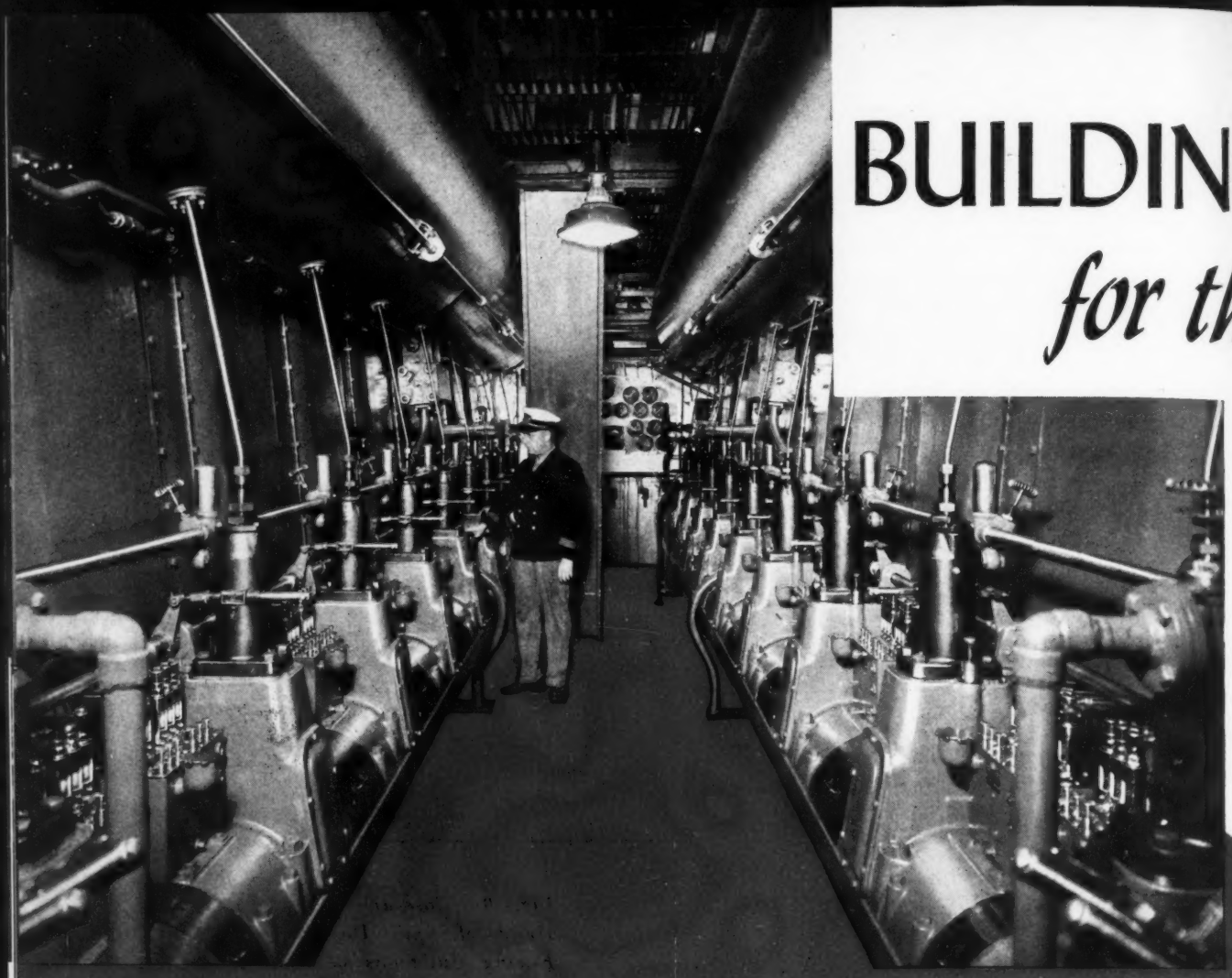


Fig. 9. Facing the End of a Rudder Casting by Employing a Fly Cutter on a Carriage that is Fed across the End of the Casting

BUILDING *for the*



TWO-CYCLE Diesel engines have been supplied in large numbers by the Nordberg Mfg. Co. for propelling the ships that are carrying troops and supplies to battle areas the world around. Many of the new ships that have been constructed for the United States Maritime Commission, as well as for the Navy, in recent years have been fitted out with this type of propulsion equipment. For example, an imposing number of C-1 cargo vessels have been provided with Nordberg six-cylinder Diesel engines rated at 2000 normal shaft horsepower at 225 R.P.M. Two of these engines are installed in one vessel for driving a single propeller, through electric couplings and a gear reduction set, at a speed of 90 R.P.M. The cylinders of this engine have a bore of 21 1/2 inches, and the piston has a stroke of 29 inches.

C-2 cargo ships built for the Maritime Commission have been equipped with nine-cylinder engines that develop 3000 normal shaft horsepower at 225 R.P.M. Two of these engines, also, are installed in a ship and drive the propeller at 93 R.P.M., either through electric or hydraulic couplings and a gear reduction unit. The cylinders of these engines also are 21 1/2 inches in diameter and the stroke is 29 inches.

Because of the satisfactory performance of these engines in service, the company has been given an order to build a large 6000 normal shaft horsepower Diesel engine for the new 16-knot Victory ship. The cylinders of this engine are bored to a diameter of 29 inches, the piston stroke is 40 inches, and the crankshaft will turn at 160 R.P.M. The engine is direct-connected to the propeller. The company is looking forward to the building of a substantial number of these large Diesel engines for new Victory ships which will soon be under construction in a number of shipyards.

The production capacity of the Nordberg plant has been widely expanded in the last few years to enable it to meet the demands of our unprecedented shipbuilding program. Several new

DIESEL ENGINES *World's Shipping*

By CHARLES O. HERB

buildings were erected and fitted out with the latest types of machine tools.

Two imposing machine tools are the Mackintosh-Hemphill crankshaft turning lathe illustrated in Fig. 1 and the Beloit crankpin turning lathe shown in Fig. 3. The Mackintosh-Hemphill lathe is now used for finish-turning and polishing the main bearings of crankshafts. This lathe has a swing of 84 inches, and takes shafts up to 50 feet long between centers. There are two carriages to enable cuts to be taken simultaneously on opposite ends of the crankshaft. The crankshaft is usually supported at two points by heavy steadyrests that are adjustable vertically.

On the crankshaft shown, the main bearings were machined to a nominal diameter of 17 inches within plus or minus 0.001 inch. The main bearings must be in line from one end of the crankshaft to the other. Crankshafts are received at the plant rough-turned, and about 3/8 inch on the diameter is removed from the main bearings and crankpins in finishing. The finish-turn cuts on bearings are taken with a broad-face gooseneck tool about 2 inches wide, which is applied with the cutting edge down, as shown in Fig. 2. The crankshaft is, of course, revolved in a counter-clockwise direction. The cheeks of the crank arms adjacent to the main bearings are also finish-faced while the crankshaft is in this lathe.

The Beloit lathe used in finish-turning the crankpins is built with two tool-heads that revolve around the stationary crankshaft, as seen in Fig. 3. Part of the crankpin is machined as the tool-head moves from left to right and the remaining portion as the head travels from right to left. This 72-inch crankpin lathe is one of the largest, if not the largest, in the country.

Fig. 1. Finish-turning the Main Bearings of a Diesel-engine Crankshaft on an Engine Lathe which Swings Work up to 84 Inches in Diameter by 50 Feet in Length

Fig. 2. (Left) The Finish-turning Cuts on the Crankshaft are Taken with a Gooseneck Tool Held in an Inverted Manner and with the Crankshaft Revolving Counter-clockwise

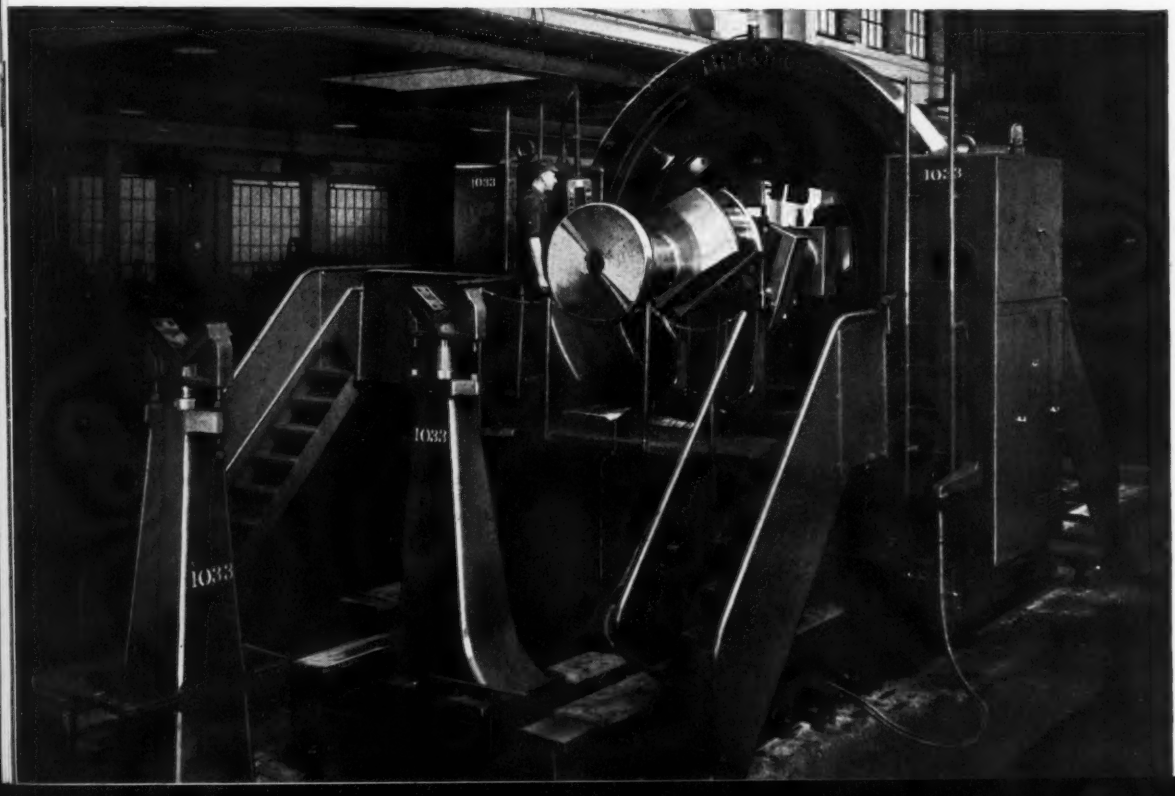
Fig. 3. (Below) Turning the Crankpins of a Large Crankshaft on a 72-inch Crankpin Turning Lathe having Two Tool-heads that Revolve around the Stationary Work

In Fig. 5 is shown an Ingersoll planer type milling machine having a table 48 feet long and a bed 100 feet long. Work up to 12 feet wide can be handled between the columns and up to 12 feet high under the cross-rail. This machine is used for slab-milling operations on the top, bottom, and ends of the big Diesel-engine bedplates and for boring the crankshaft bearings. The illustration shows the boring operation in progress. The boring head is equipped with five tungsten-carbide cutters set to machine to a diameter of 17 inches.

The bed seen on the machine was cast in two sections. It was necessary to mill the ends of these sections on the same machine before they were bolted together. The total length of the assembled bed is 40 feet. Face mills up to 24 inches in diameter are used in finishing pads on the top and bottom of these engine beds.

A Cincinnati Bickford radial drilling machine is seen in Fig. 4 mounted on a truck that runs in tracks embedded in the floor to facilitate a series of drilling, reaming and back-facing operations on engine beds. Jig plates fastened to dowel-holes in the bed are used to insure accurate location of the holes produced with the jig plate in three different positions along the bed. The particular jig plate seen in use has thirty-six drill bushings and is employed for drilling the holes for all eight columns later to be assembled on the bed.

There are six cored holes around each crank-



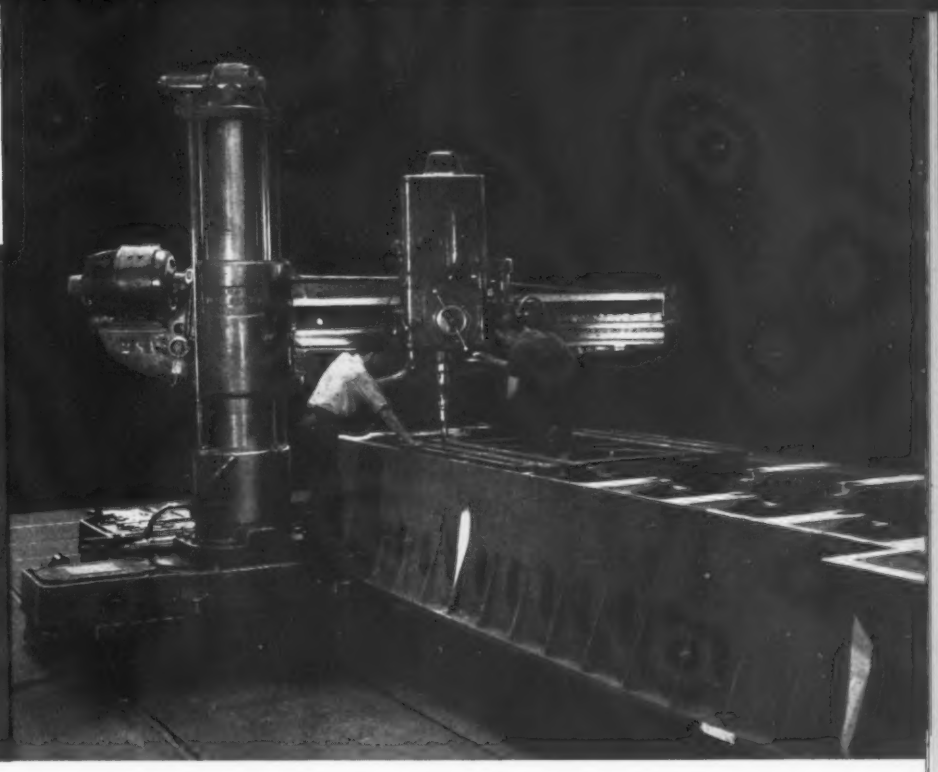


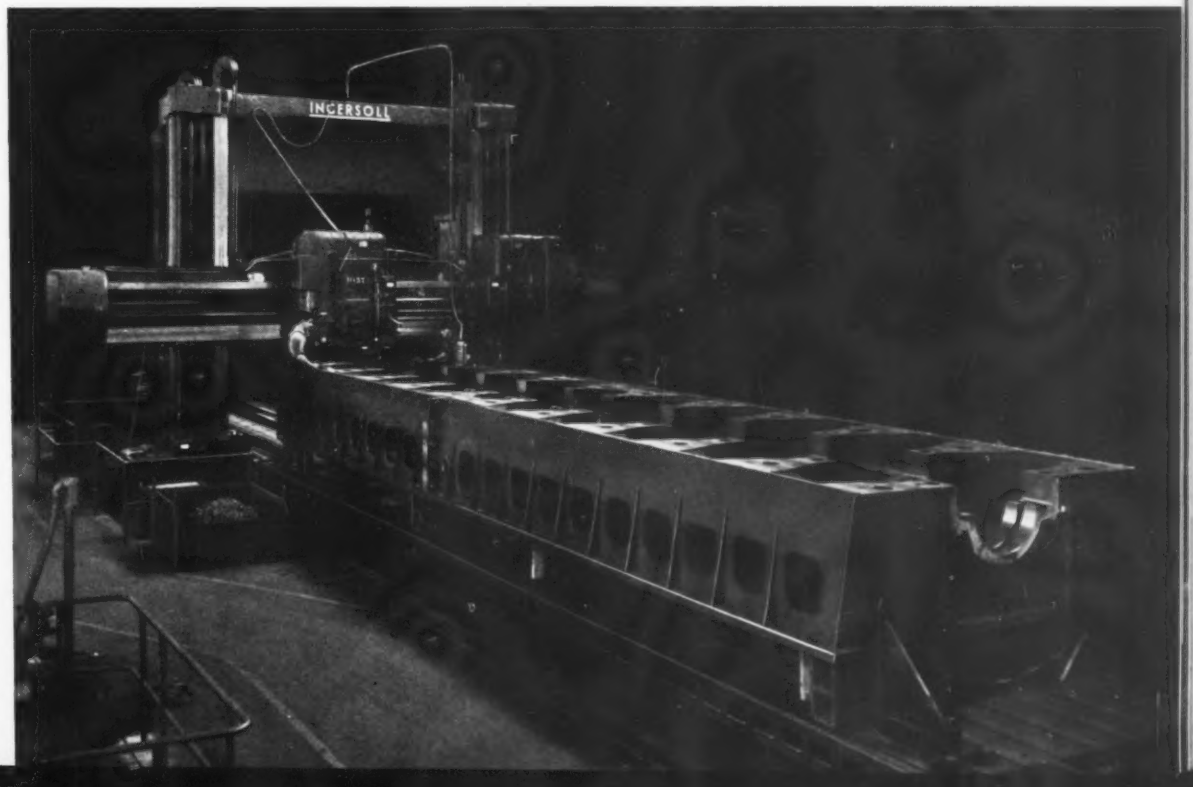
Fig. 4. (Right) Using a Radial Drilling Machine Mounted on a Floor Truck to Drill, Ream, and Back-face a Large Number of Holes in the Top of Diesel-engine Bed Castings

Fig. 5. (Below) Heavy Beds for Diesel Engines are Milled and their Crankshaft Bearings Bored on a Planer Type Milling Machine Equipped with a Table 48 Feet Long

shaft bearing to be drilled, reamed, and back-faced. Two of these holes are 4 inches in diameter and have a total length of 23 inches. There are cored recesses between the finished sections of these holes. The four remaining holes are 2 inches in diameter by 11 inches long, with cored pockets between two finished ends. Other holes produced with the aid of this jig plate range from 1 15/16 to 2 1/4 inches in diameter.

In Fig. 6 is shown a Carlton radial drilling machine of considerably larger size than the machine just described, which is used for similar operations on bed castings. This machine has an arm 10 feet long and a column high enough so that the arm can be raised until the bottom end of the spindle is 10 feet above the floor. The column is 26 inches in diameter. This radial drilling machine is mounted on a bed which is equipped with heavy wheels that run along a floor track.

Crankpin bearing boxes, which are later assembled to the ends of connecting-rods, are being bored three at a time in the operation shown in Fig. 7. This operation is performed on a Giddings & Lewis horizontal boring, drilling, and milling machine equipped with a tool-bar on which three cutter-heads are mounted. The bearing-box halves are assembled before being brought to this machine, and are located on fixtures which insure accurate finishing in relation to the surface on which the boxes are to be mounted on the connecting-rods.



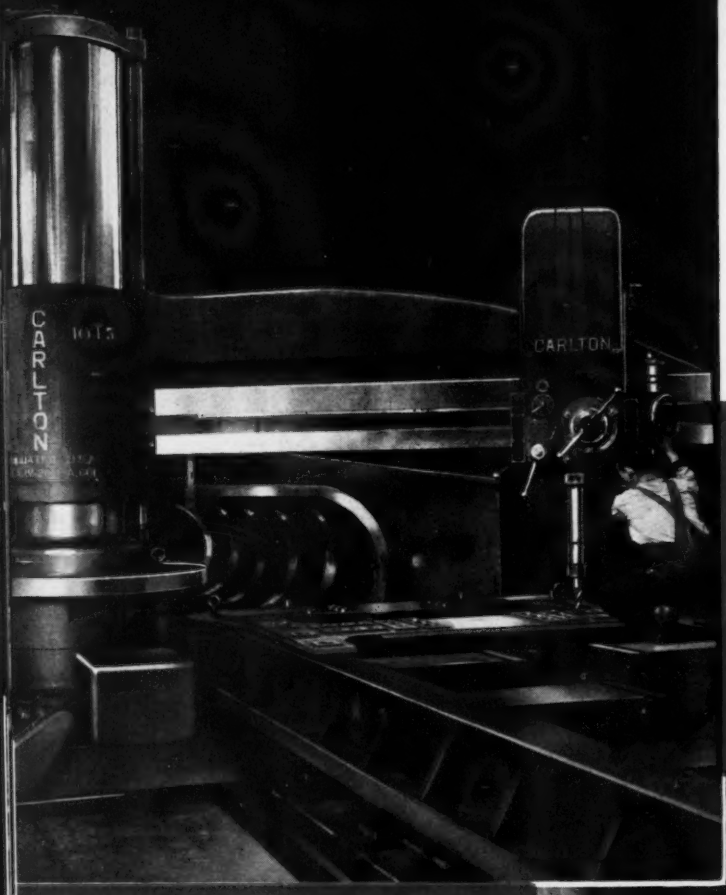


Fig. 6. (Left) Another Radial Drilling Machine Arranged to Run along a Floor Track, which has an Arm 10 Feet Long and Accommodates Work up to 10 Feet High above the Floor

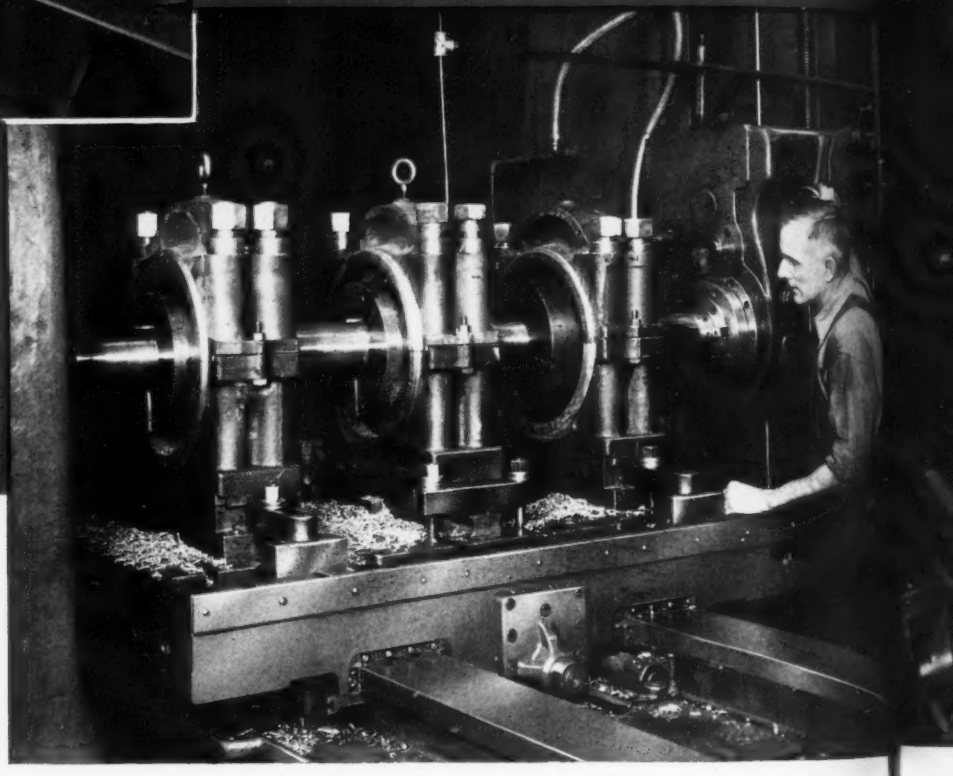


Fig. 7. (Right) Boring and Recessing, Three at a Time, Crankpin Bearing Boxes to be Assembled on Diesel-engine Connecting-rods

The bearing boxes are bored straight through in this set-up, and a circular recess is also bored around the center of the boxes for locking the babbitt that is to be poured in the bearings. Two cutters are used on each head. After the babbitt has been cast, the bearing boxes are returned to this boring mill for finish-machining.

The piston-pin bearings of three connecting-rods are being simultaneously bored by a Giddings & Lewis horizontal boring, drilling, and milling machine in Fig. 9. For this operation, the ends of the connecting-rods to which the crankpin bearing boxes will be attached are mounted on the vertical face of a heavy fixture at the back end of the table. Near the front end of the table the arms of the connecting-rods are accurately seated in another fixture and clamped to insure correct alignment and concentricity of the bearings with the boring-bar.

In Fig. 8, a cylinder block for a 21 1/2-inch bore engine is seen being bored on a Niles vertical boring mill to receive a liner. Two fits

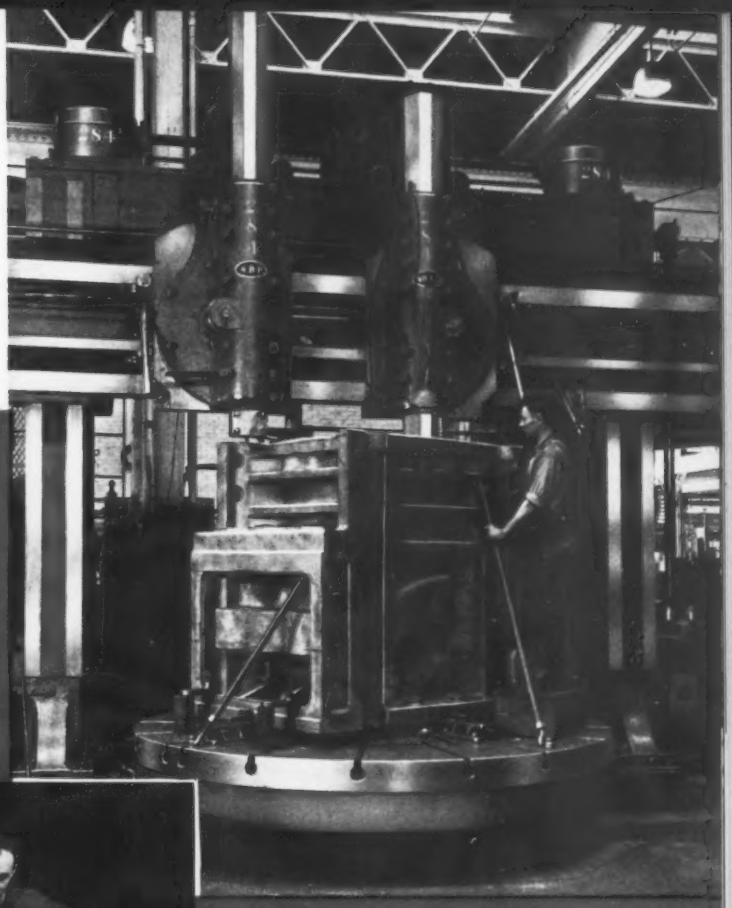


Fig. 8. (Right) Boring Cylinder Block Ready for Its Liner on a Vertical Boring Mill; Sides of Cylinder Blocks are Faced in Same Type Machine with Work Held in an Indexing Fixture

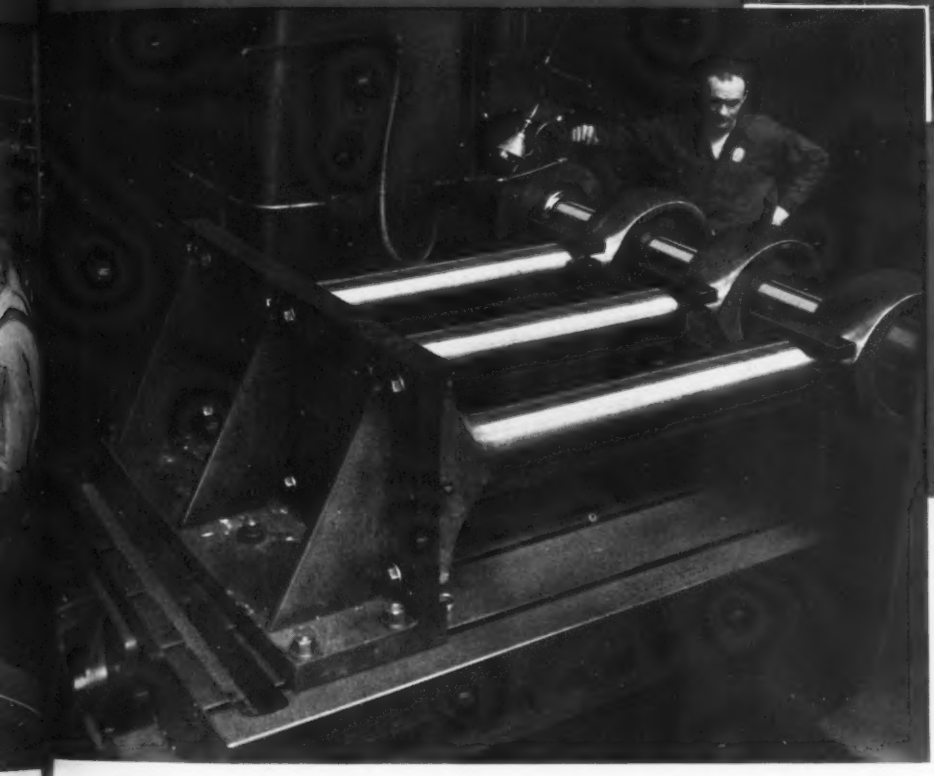


Fig. 9. (Left) Boring the Piston-pin Ends of Three Connecting-rods Simultaneously on a Horizontal Boring, Drilling, and Milling Machine

are machined at the top and bottom of the cylinder block and two additional fits near the middle. The four sides of the block are later faced on the same machine while mounted horizontally on a fixture that can be indexed to bring each side uppermost for the facing cut.

Fig. 10 shows a Libby turret lathe being used for rough-turning a piston that is held at one end by the jaws of the headstock chuck and at the other end by an adapter mounted on one of the turret faces. This adapter is free to revolve with the work. Provision has been made, however, for supporting the right-hand end of the piston in a steadyrest, so as to enable a boring cut to be taken simultaneously with turning cuts.

After the pistons have been finish-turned, they are ground to size in the large Norton cylindrical grinder shown in Fig. 11, which has a swing of 32 inches and a capacity of 15 feet between centers. In this operation, the piston is driven by a dog on the faceplate, which revolves around a stationary work-holding member.

Fig. 10. Turning a Piston in a Turret Lathe and also Machining the Ring Grooves

Oil-holes 3/4 inch in diameter are drilled through 39 1/2 inches of solid metal in the arms of crankshafts by means of the special step drilling machine developed by Nordberg, which is shown in Fig. 12. This machine is called the "Woodpecker" because of its operating principle. The drill head of the machine is fed back and forth intermittently by hydraulic means from the start of an operation until the hole has been drilled to the required depth. Each time the drill moves forward it advances 9/16 inch farther than the previous time. At the end of each stroke, the drill is withdrawn completely from the hole to permit all the chips to be ejected before it again enters the hole on the next stroke.

Each time that the head is advanced, it traverses rapidly until the drill reaches the point where it left off on the preceding stroke. Then the drill is fed at a slow rate for slightly more than 9/16 inch. The oil-holes are drilled from each main bearing to the middle of both adjoining crankpins, and they are joined in the center of the crankpins by similar oil-holes drilled from the next main bearing. This means that joining oil-holes are drilled at opposite angles to each other. The drilling machine is mounted at the drilling angle on a truck which runs on floor tracks. After all oil-holes have been drilled in one direction, the crankshaft is reversed on its stands to permit drilling the holes in the opposite direction without changing the seating of the machine on its truck.

At the start of each operation, a jig is clamped on the main bearing, as illustrated, to insure

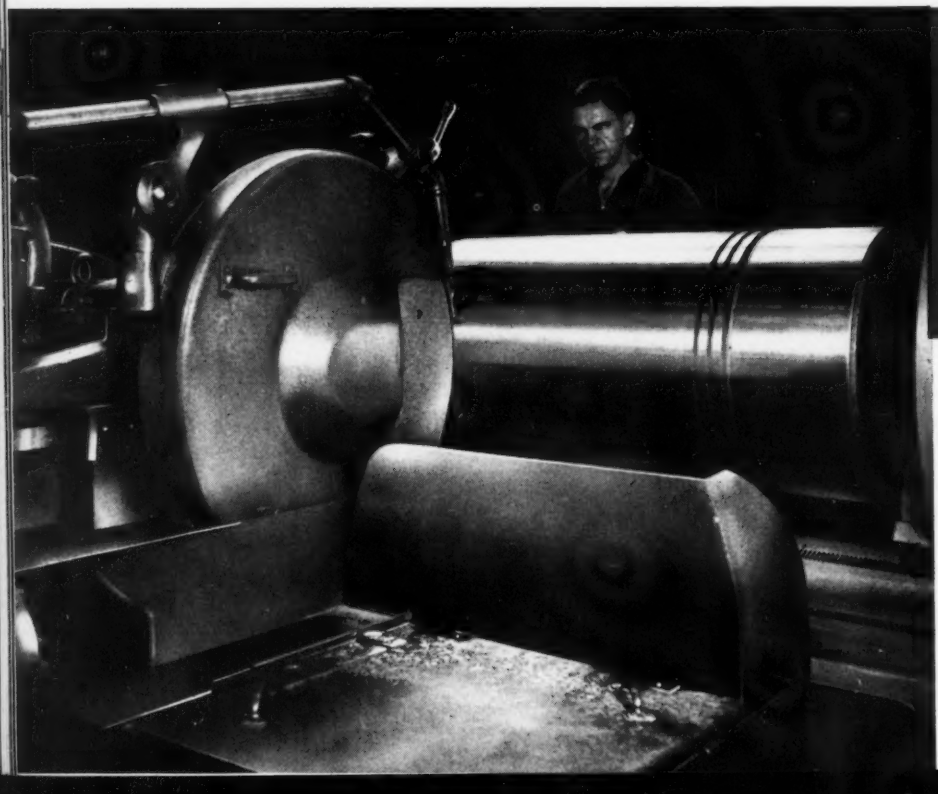


Fig. 11. Grinding One of the Large Diesel-engine Pistons to Finish Dimensions

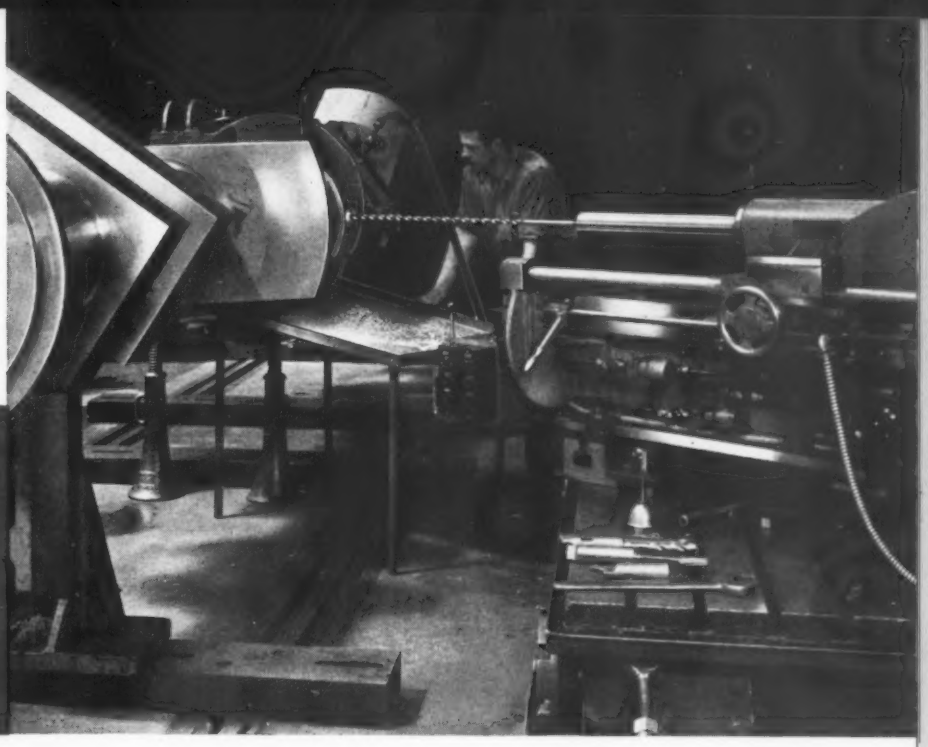


Fig. 12. Drilling 3/4-inch Oil-holes through Crankshaft on Special Machine

accurate location of the oil-hole. The truck on which the drilling machine is mounted is clamped to the floor rails after the drill has been located, so as to prevent any truck movement during the operation. The hydraulic cylinder that actuates the drill head is mounted midway between the bedways of the drilling machine.

Piston-pins are produced from solid bars of steel 12 3/8 inches in diameter. The first operation after the stock has been cut from long bars consists of turning, drilling, and boring. This operation is performed on a Libby turret lathe. From this machine the piston-pins are transferred to the DoAll sawing machine illustrated in Fig. 13, where four segments of stock are cut off the ends, as indicated by the piston-pin seen resting on boxes at the front of the machine. The piston-pins are mounted in a fixture for the sawing operation, so as to insure that all cuts will be taken in proper relation to each other.

This fixture is mounted on the machine table so as to position the work for successive cuts. Accurate location in each position is insured by entering locking pins on opposite sides of the fixture into dowel-holes on the table slide. In cutting off two of the segments, cuts about 4 inches in length are taken along the piston-pin, and about 2 1/2 inches in length crosswise. Before this machine was installed, it was the practice to remove the stock on the ends of the piston-pins by shaping.

In the final operation, the piston-pins are ground to their nominal size within plus or minus 0.0005 inch.

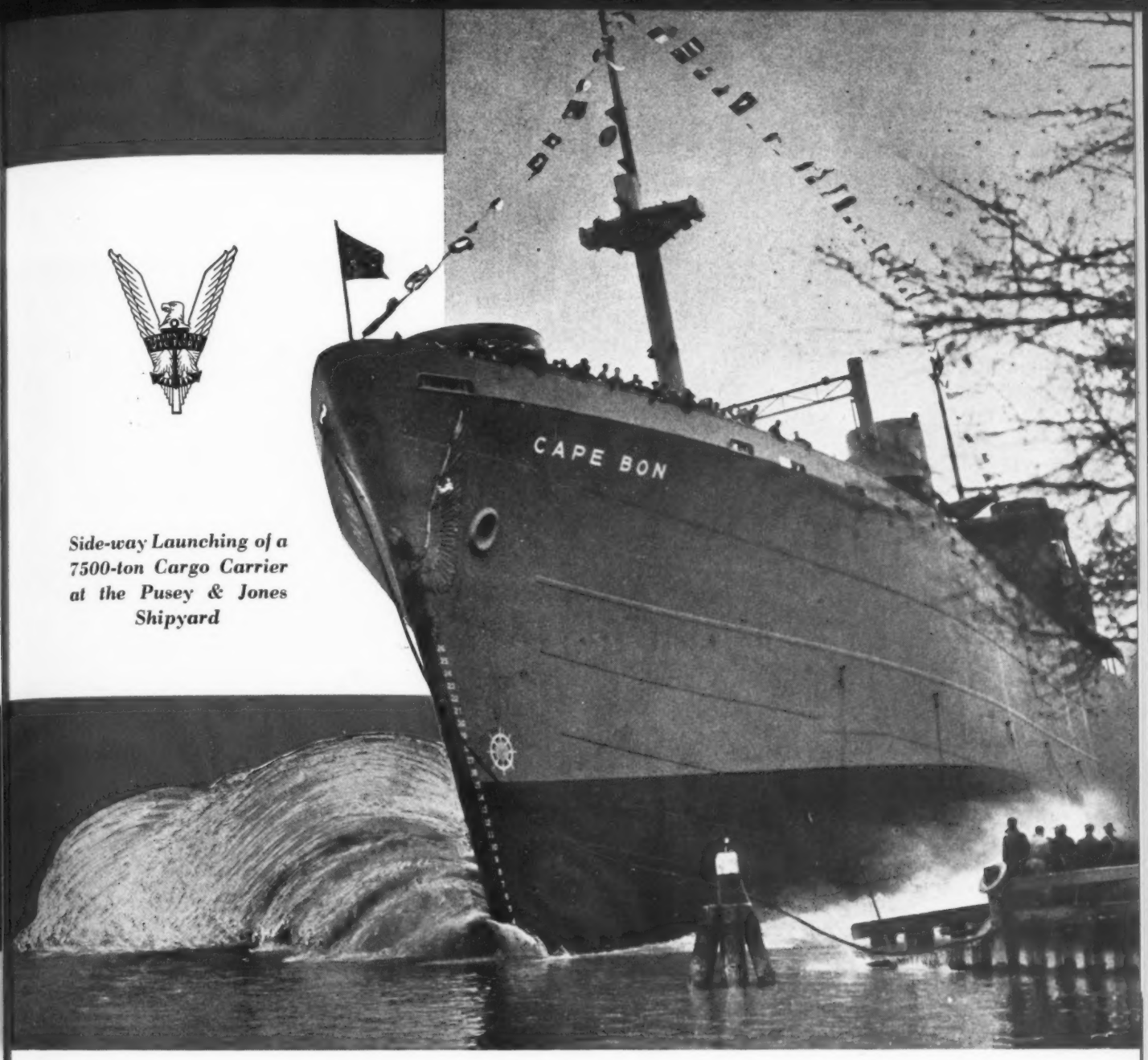
Fig. 13. Employing a Sawing Machine for Cutting Segments from Piston-pins

Wartime Activity at PUSEY AND JONES

THE Pusey & Jones Corporation—the first yard in the United States to launch an iron-hull sailing vessel (the *Mehlon Betts,* in 1848)—has had a long and illustrious career in the shipbuilding field. Among the nation's first shipbuilders to gain distinction as constructors of successful America cup defenders, Pusey & Jones built the famous metal-hull sailing sloop *Volunteer,* which beat the British challenger *Thistle* in the closely contested International Series of 1887 off Sandy Hook. The *Volunteer* was the predecessor to a galaxy of steam yachts built by the firm in the nineties and up to World War I, following which the firm's yacht-building era was climaxed by the larger type Diesel yachts, now serving as converted military ships in the Naval and Coast Guard Services.

With a background of sound engineering and quality production dating back to the naval machinery built during the Civil War for fighting craft, it was logical that the firm should engage in building military vessels, commencing in 1908 with the army mine planter type for the War Department and later producing the more complicated sea-going hopper dredges to the exacting requirements of the U. S. Army engineers.

Fig. 1. Early Construction Stages of a New Cargo Vessel, Showing Seven Prefabricated Inner-bottom Sections in Place



Side-way Launching of a 7500-ton Cargo Carrier at the Pusey & Jones Shipyard

The firm also gained prominence through the design and construction of the country's fastest coastal freighters, the 19 1/2-knot, 5000-H.P. *Quaker* and *Cavalier*. This was in 1938, and made an apt prelude to the corporation's sea-going cargo-carrier program, which commenced a year later.

Today, the Pusey & Jones Corporation is continuing this program on a much larger schedule through its construction of numerous 413-foot, 7500-ton, C1-A type Maritime Commission cargo-passenger ships, which are 4400-H.P. turbine-driven naval auxiliaries of peacetime conception and a part of the Commission's long-term program. Despite having but two side-launching ways, the firm is delivering these craft, as the year closes, on an average of seventy-seven days ahead of the specified dates.

The side-launching ways were employed at this shipyard, which is located on the Christina River, because they could be designed to permit the construction of 500-foot vessels having a 65-foot breadth. This would have been impossible with end-launching ways on the same property. The new side-launching ways are served by 45-ton gantry cranes and other modern facilities.

A cargo merchant ship in its early stages of construction at this yard is shown in Fig. 1, where seven prefabricated inner-bottom sections have been laid in place. Close by, a superstructure enclosure, representing the lower part of a three-deck house, is being pre-erected as shown in Fig. 2. When finished, it will be lifted aboard ship for main-deck connections and ultimate outfitting. An inner-bottom section can be seen under construction in the middle distance.

Fig. 2. In Foreground, Work on a Prefabricated Superstructure Unit is Under Way. Some Distance beyond, an Inner-bottom Section is being Built, and behind This, a Merchant Ship can be Seen under Construction

A combination of welding and riveting is employed in the construction of these ships. This is illustrated by the view of the ship stern assembly shown in Fig. 3. Here the shell plates are held in place by bolts preparatory to riveting the cant frames and lapped seams. The butts of the shell plates are welded in order to provide a smooth continuous exterior surface.

In Fig. 4 is shown the boring of the aft end of a stern tube for one of these cargo carriers. This bore is 22 inches in diameter and about 5 1/2 feet long. The total length of the tube is nearly 16 feet. The operation is being performed on a Niles-Bement-Pond lathe with a 38-foot bed.

A large proportion of the Kingsbury thrust bearings manufactured in this country for ships of all types is produced in the Pusey & Jones yard. In Fig. 5, the babbitted surfaces of a 32 1/2-inch Kingsbury bearing are being bored on a Sellers horizontal boring mill to a diameter of 14 1/4 inches.

The bottom surface of a cast-steel base ring for a 32 1/2-inch Kingsbury bearing is seen being faced on a Bullard 50-inch vertical turret lathe in Fig. 6. The first operation on this piece is to rough- and finish-turn the outside diameter, and the second operation is to rough- and finish-bore the inside diameter. After facing the top, the work is rechucked in an inverted position, the bottom faced off, and a smaller outside diameter finish-turned, as shown in the illustration. A high-speed steel cutting tool is employed for this operation, and the cut is taken at a speed of 60 feet per minute with a feed of 1/32 inch.

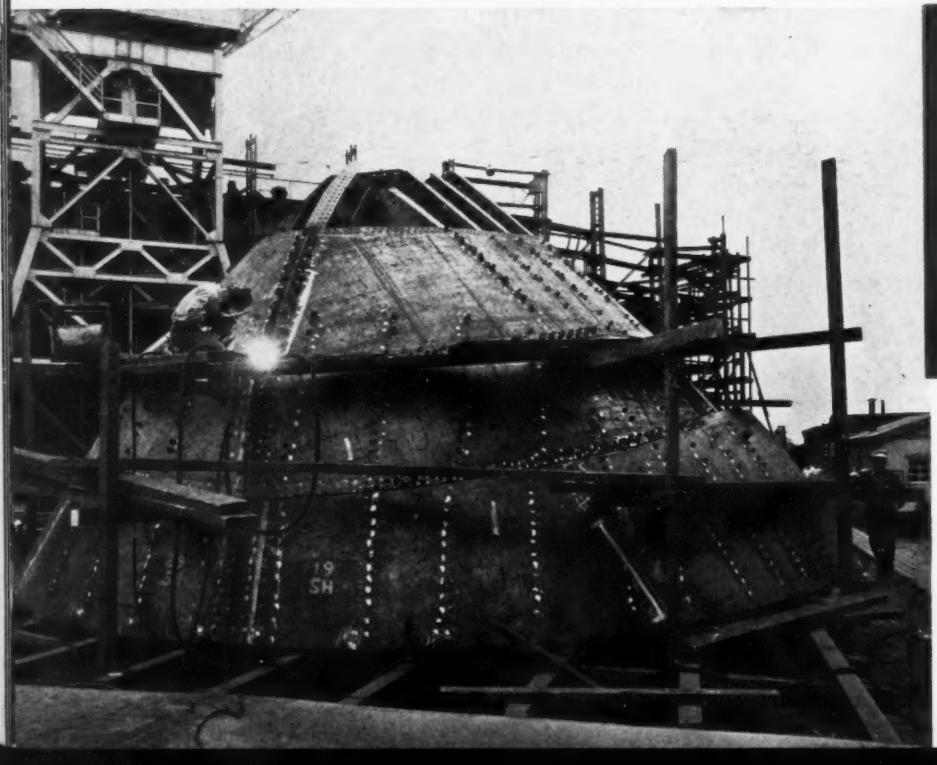


Fig. 3. Both Welding and Riveting are Used in Constructing the Cargo Ships. Here the Shell Plates are Riveted to the Cant Frames, and the Butts are Welded to Provide a Smooth Continuous Outer Surface

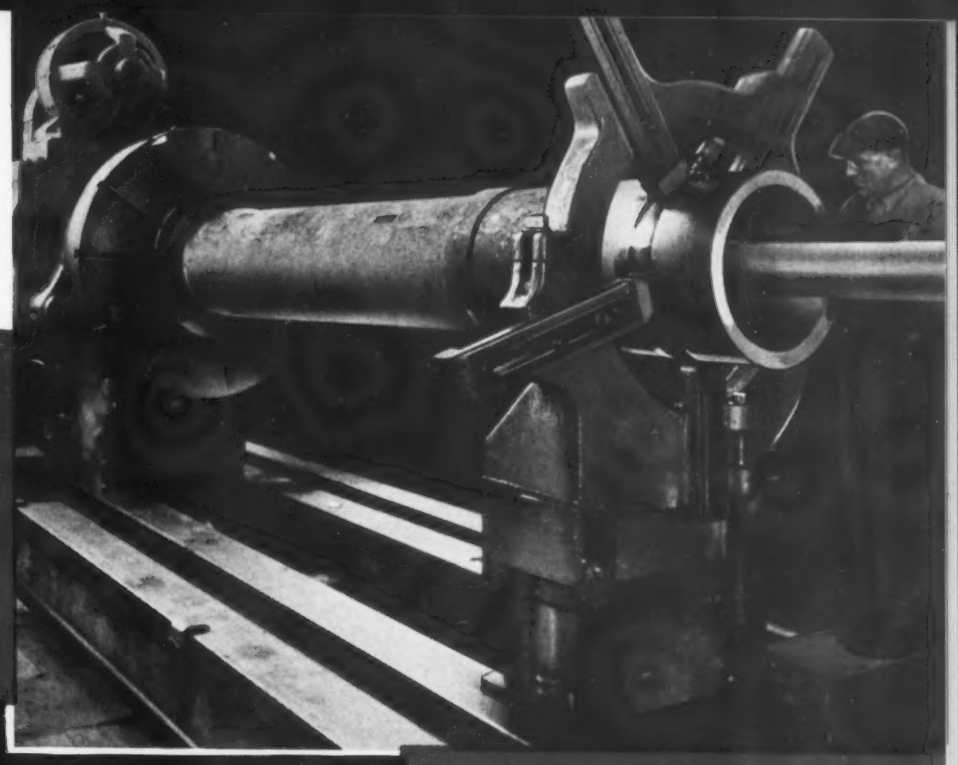


Fig. 4. (Right) *Boring Aft End of a Stern Tube for Cargo Carrier. The Bore is 22 Inches in Diameter and About 5 1/2 Feet in Length*

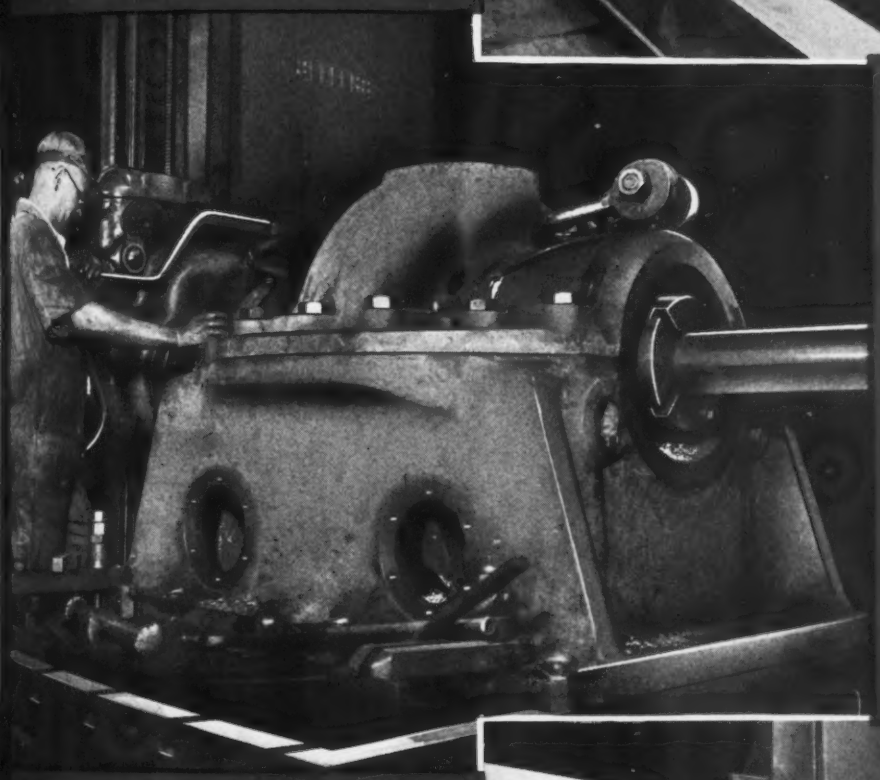


Fig. 5. (Left) *A Large Number of Kingsbury Thrust Bearings are Produced at This Plant. The Illustration Shows the Babbitted Surfaces of a 32 1/3-inch Bearing being Bored*

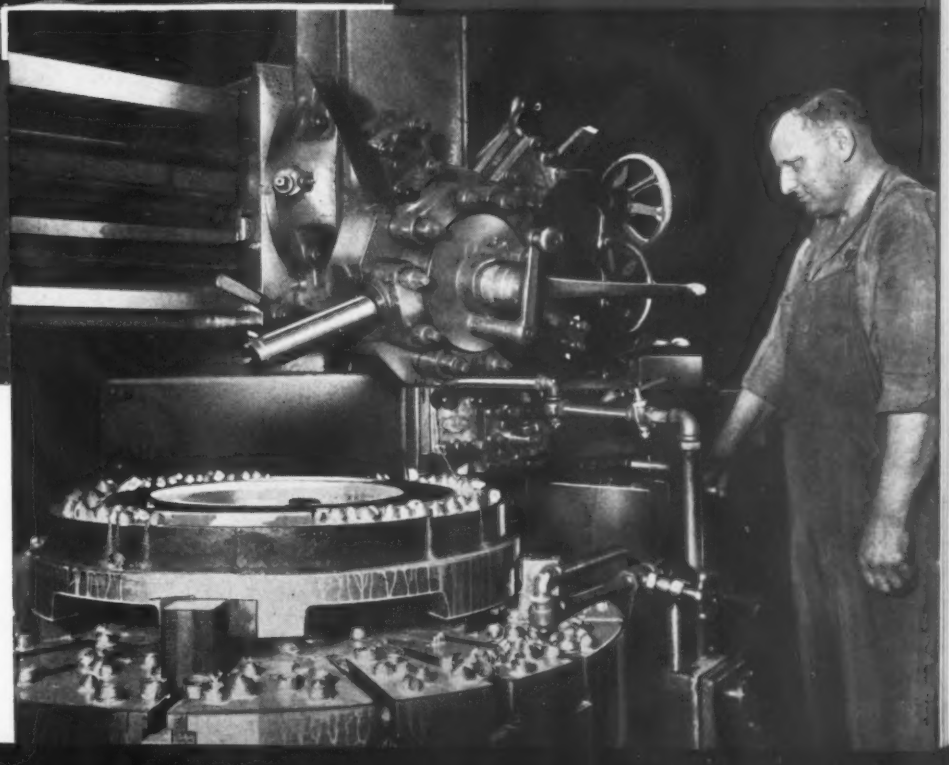
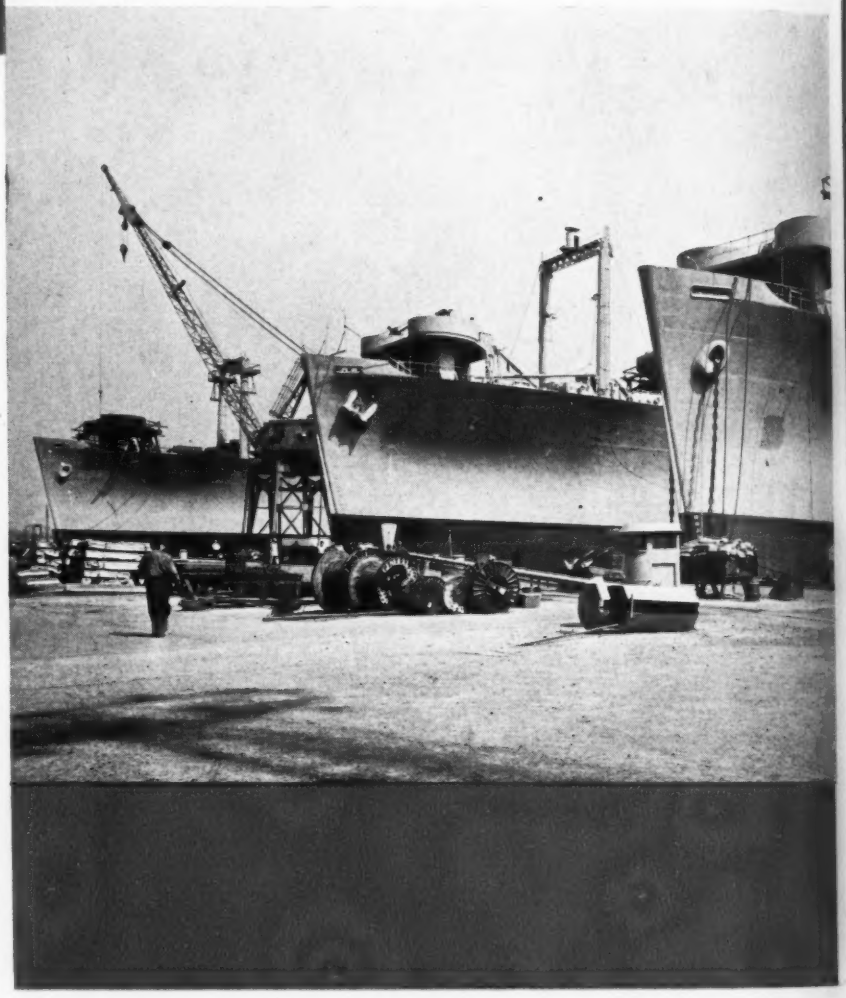


Fig. 6. (Right) *Facing Bottom Surface of Cast-steel Base Ring for Kingsbury Bearing on Vertical Turret Lathe—Speed, 60 Feet per Minute; Feed, 1/32 Inch*

TRAINING *for the Production*



TWO years ago the management of Sun Shipbuilding & Dry Dock Co. saw the opportunity of placing colored men in the field of skilled crafts when the United States Maritime Commission requested that eight more ways be added to its plant to build some special cargo ships. With a small number of colored men already working at skilled and semi-skilled work, the concern felt that with proper training, other colored men could handle the work in all crafts in shipbuilding.

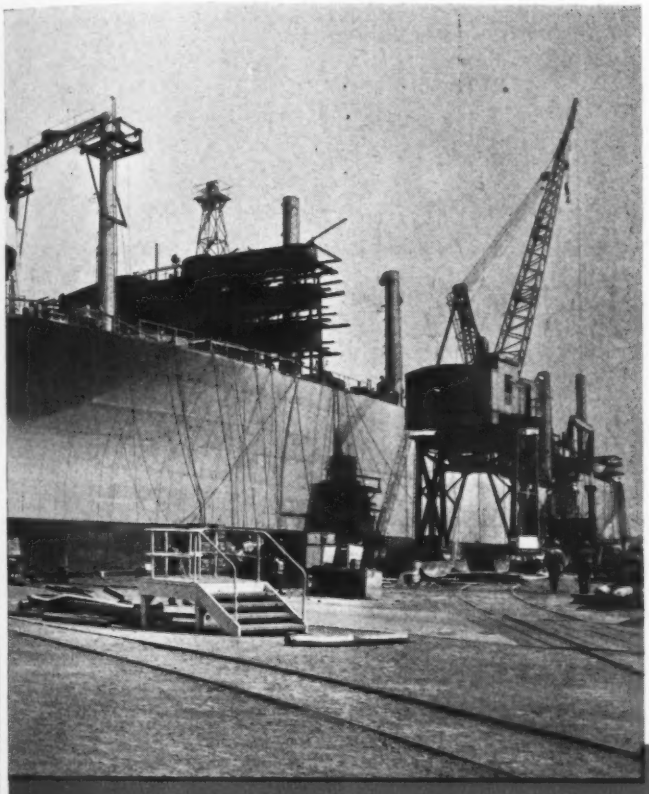
With the Selective Service making large inroads on the working force, and with many unskilled colored men available in the area, this move has materially aided in keeping the ships sliding down the ways in Chester, Pa.

The No. 4 yard was planned to be manned solely by negroes who would be trained to perform all the work required in building modern merchant vessels. At first there was to be white supervision—foremen, assistant foremen and leaders—but eventually these would be replaced as individual negroes demonstrated their ability to take over the supervisory duties.

There were difficulties at first, of course. Many of them arose out of prejudice. Thus, some white workmen didn't believe the negro had the ability to absorb in a short time the kind of training necessary for performing the various skilled jobs in shipbuilding. Fortunately there were already in the employ of the concern a small number of negro workmen in skilled and semi-skilled crafts, as well as a large number of negro workmen in the so-called laboring department, performing such duties as sweeping, cleaning, etc. They had been around the Sun plant long enough to know something about shipbuilding and the various operations involved. These men were given the first opportunity for training and instruction in the various crafts. They went to school during off hours, and worked alongside white men in the three yards then in operation to learn the various skilled and semi-skilled jobs involved in ship construction.

As soon as the new yard was far enough along

THE NEGRO *Front Line*



By HOLBROOK L. HORTON

Here is Concrete Evidence of an Outstanding Accomplishment in the Field of Job Training. Starting from Scratch with Only a Few White Foremen and Leaders, Sun Ship has Manned an Entire New Shipyard with Over 7000 Trained Workers Taken from the Ranks of Unskilled Negro Labor. These Negroes have been Taught to Build Merchant Ships from Bow to Stern, from Keel to Stack

John G. Pew, Sr., President of Sun Ship, and Raechel Stevens, Sponsor at the Launching of the First Ship from Yard No. 4

and between one and two thousand negroes were trained sufficiently, they were transferred to the new No. 4 yard to work on a skeleton basis. Many others followed. Thus the employment of colored workers in the Sun shipyards rose from around 2000 in June, 1942, to about 7000 in December, 1942, and to approximately 13,000 in August, 1943. About 60 per cent of these are employed in the new No. 4 yard. The remainder are working side by side with white workers in the other three yards.

This training program has made it possible to meet the critical labor shortage throughout the

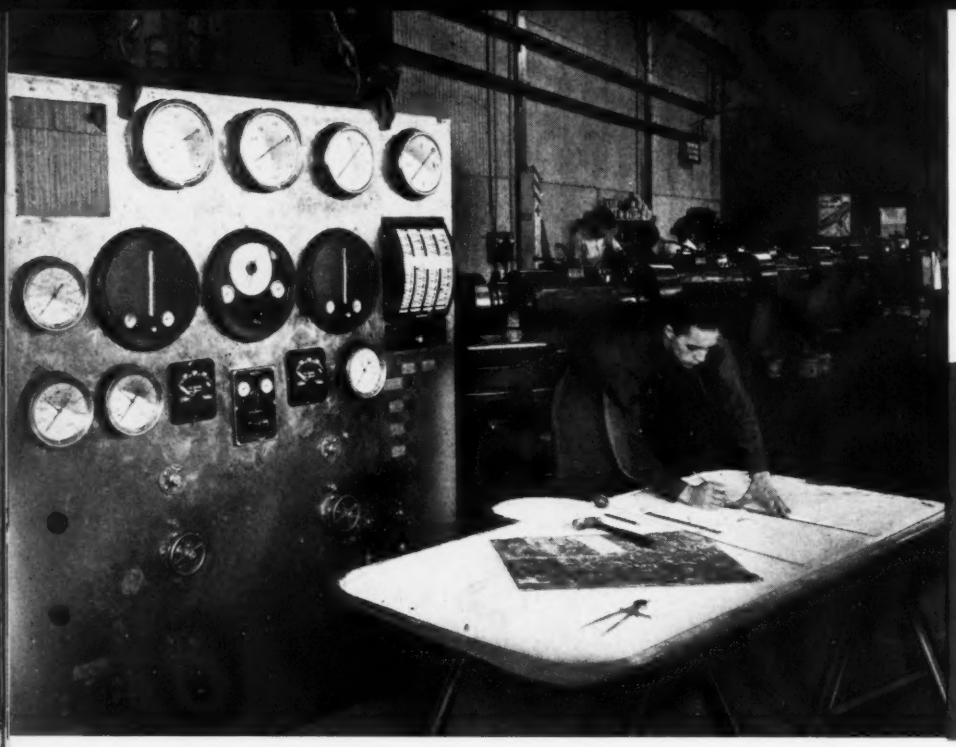


Fig. 1. (Left) A Young Negro, Formerly a Laborer, Making the Complete Lay-out for an Engine-room Cage Board from Blueprint

Fig. 2. (Below) Another Operator, Previously a Laborer, Engaged in Drilling Steel Pads for a Tank Lifting I-beam

entire plant. Even more significant than the rise in colored employment, however, has been the opening of opportunities to negroes in all of the skilled trades required in shipbuilding. In the words of John G. Pew, Sr., president of Sun Shipbuilding & Dry Dock Co.:

"Enlightened industry everywhere has come to recognize the vitally important part that the great reservoir of negro labor can play. In the case of the Sun Shipbuilding Co. we have gone a bit further and have opened a shipyard covering acres of ground with eight shipways in which opportunity is being offered colored men for service in shipbuilding crafts, opportunities never before opened to them on such a wholesale basis. These men receive not comparable but equal wages, such as may be paid men for performing similar tasks anywhere else in the plant.

"Our 'hirings' of colored labor have gone considerably beyond the usual percentages, it will be noted, and have opened the way for trained men to enter upon employments with upgraded opportunity as to promotion and wages. It is a satisfaction to say that we are greatly pleased with the fine, loyal, and cooperative services being rendered by these colored employes. They are making good."

One of the reasons for the initial success of this project was undoubtedly the exceedingly competent all-negro personnel organization which the management set up in the new yard under the supervision of Dr. Emmett J. Scott, a leading negro educator and former secretary to Booker T. Washington. All of the negro applicants are interviewed and hired or rejected in this personnel office completely staffed by negroes.

Two of Dr. Scott's assistants, "Brud" Holland, all-American football star in 1938 and holder of a master's degree in Sociology from Cornell University, and Lucius Robertson, an ordained minister, are located in an office right in the middle of the yard, where they are easily accessible to those who have a grievance. These two men have done much to build up the self-confidence and sense of responsibility of their fellow workers.

Fig. 3. (Right) Exceptionally Capable Engraving Machine Operator, who a Year ago was Working as a Domestic Servant

Fig. 4. (Below) Woman Operator Setting Change-gears of a Bolt-threading Machine to Thread Eyebolt for a Cargo Port Door

Much credit, however, must go to the negroes themselves, who, in case after case, have risen to the opportunity presented, have studied in the classes provided after working hours, and have worked their way up to more and more difficult jobs requiring considerable skill. Most important of all, they have overcome the prejudice and disbelief in the minds of some who felt that they were not equal to the opportunities presented. In the machine shop, for example, there are about 250 operators, of whom 55 or 60 are second-class machinists, trained at the Sun yards.

In Fig. 1, a young negro, formerly a laborer, who has been in the yard about a year and has been promoted to a second-class machinist, is making the complete lay-out of an engine-room gage board from the blueprint shown. The completed boiler-room board standing at the left was machined and assembled in this shop. Fig. 2 shows an operator, who less than a year previous was a laborer, engaged in drilling steel pads for a tank lifting I-beam.

Negro women are also proving to be skillful and fast workers on certain types of operations. The operator of the Gorton engraving machine shown in Fig. 3 is one of the most rapid in the plant on this type of machine. Less than a year ago she was working as a domestic servant. Another negro woman is shown in Fig. 4 setting the change-gears of a Landis bolt-threading machine in preparation for threading the eyebolt for a cargo port door.

In the forge shop, negro workers have been found both capable and willing. Fig. 5 shows a large davit being forged to shape under a Bement-Niles steam forging hammer. The man engaged in turning the bar is the leader of the crew that performs this operation, and is rated as a first-class forger.

In Fig. 6, a large composite weldment consisting of a cofferdam, two fuel-oil settling tanks, ammunition chambers, and a section of the ammunition chamber hoist is being welded close to a shipway by a group of men and women welders.

In addition to the jobs mentioned, negro workmen are actively engaged on vessels under con-

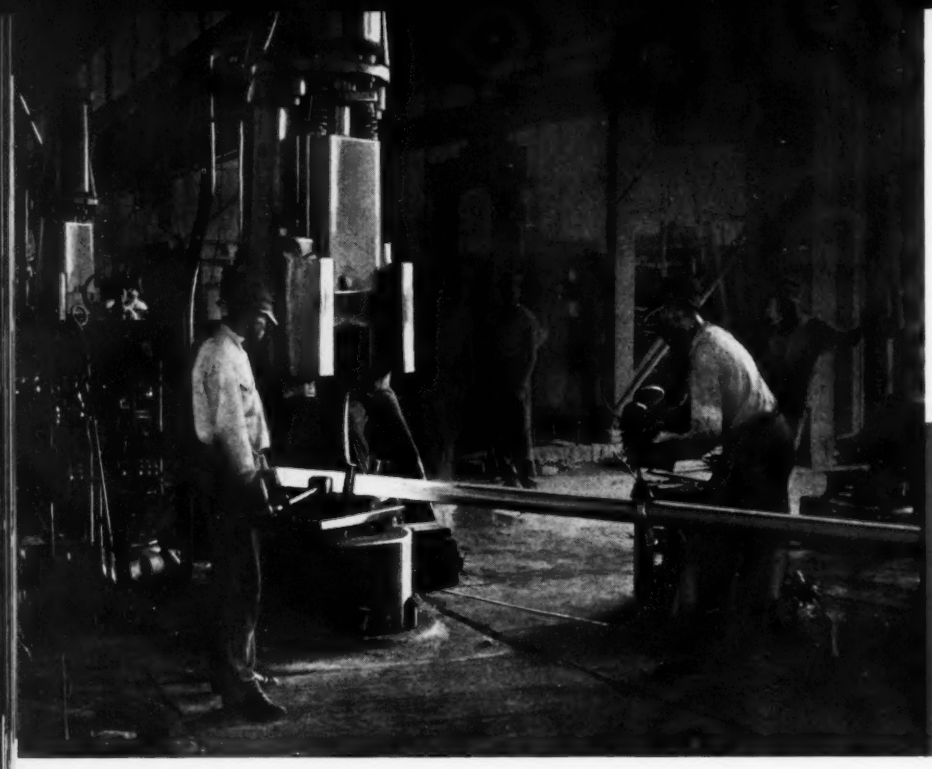


Fig. 5. Forging a Large Davit to Shape under a Steam Hammer. Negro Crew Leader who is Turning Bar is Rated a First-class Forger

struction as ship fitters, chippers and corkers, erectors, regulators, welders, carpenters, stage builders, painters, burners, and riggers.

It is probably too early to draw any final conclusions from this new venture, but certain facts already seem to be evident: For one thing, negroes can be trained to do jobs requiring considerable skill and can make good progress in training. In many cases where the negro does not advance as fast as the white worker, it seems to be due to the fact that in the beginning he lacks initiative. This may well be the result of previous experience, when he was always told exactly what to do. One of the hardest things for a negro to learn is that he must do his own job and planning. Then, too, it has been found necessary to convince the negro that a sincere effort is being made to help him and to train him. Because of his own experience and that of his race, his inclination is to accept anything concerning his progress or welfare with reserve.

It is realized that the negro cannot be converted by a brief training course and an opportunity for advancement from a truck driver, a porter, or an agricultural worker to a skilled and efficient shipbuilder in four or five months, or even a year. Yet in the face of many difficulties, the Sun Ship management believes that these negro employes show a new attitude and an awakened sense of responsibility which they did not have before. Dr. Scott, "Brud" Holland, and Lucius Robertson are convinced of the venture's ultimate success, while admitting the host of problems still to be overcome.

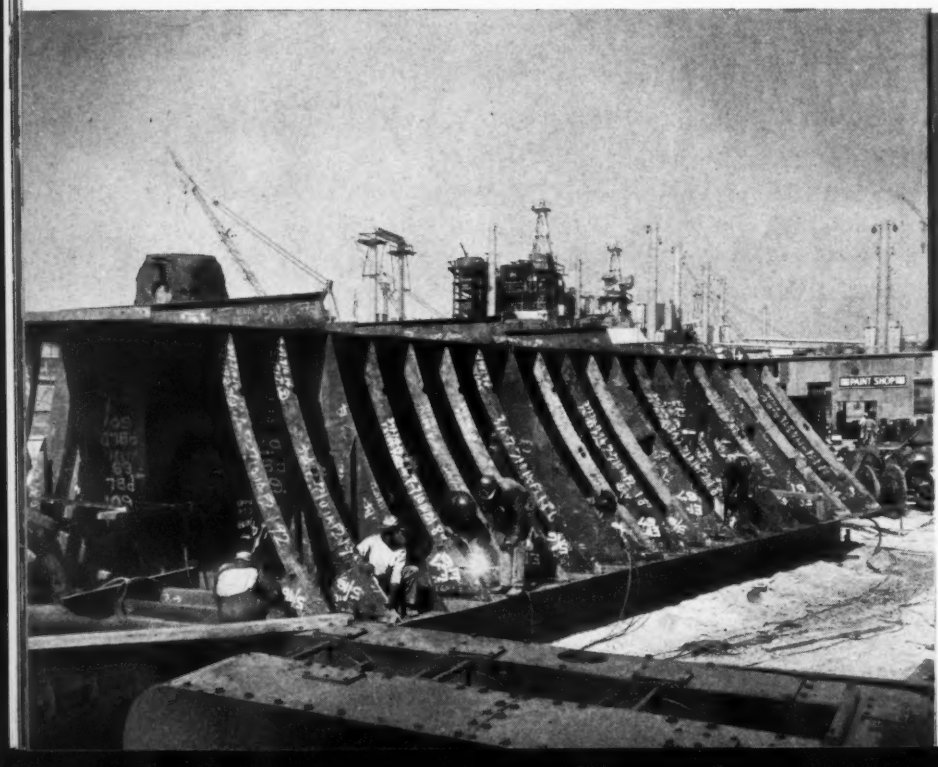


Fig. 6. Large Composite Weldment Consisting of Cofferdam, Fuel-oil Settling Tanks, Ammunition Chambers, and Ammunition Chamber Hoist

Government Employes Should Set Example in Conservation

Industry and individuals are constantly being asked by the Government not to make long-distance telephone calls unless absolutely necessary; not to use the telegraph service if a letter will serve the purpose; not to do any unnecessary travel by plane, railroad, or bus; and to conserve paper to the utmost extent.

This is as it should be. We are engaged in a serious emergency—in a war, the winning of which will require the utmost effort and the saving and conservation of all our resources; but the Government should set a good example. Washington authorities and bureaus and the Government offices scattered throughout the country should do exactly what they ask industry and the public to do.

Every industrial concern handling war contracts knows how many unnecessary long-distance telephone calls are made by men employed by Government bureaus. They can point to lengthy telegrams sent in cases where a letter would have done just as well, and to the enormous amount of paper used by Government agencies in issuing apparently unnecessary bulletins, regulations, and publications of doubtful value.

Travel could be greatly curtailed by the men in these Government agencies. In many instances, on the smallest pretext, men in Government employ take a plane or a train to a distant point when personal visits are not essential.

It is everybody's duty to do all that can be done to aid the war effort; and on the whole, the American people are doing a good job in that respect. But it would be much easier to do all these things cheerfully if there were not so many examples of Government waste of the very resources that the rest of us are expected to conserve.

* * *

Industrial Belting Made from Synthetic Rubber

Volume production of industrial belting made from synthetic rubber has been started at the Passaic, N. J., plant of the United States Rubber Co., Rockefeller Center, New York City. Synthetic rubber belting will alleviate the shortage of transmission and conveyor belting that threatened industry when the sources of natural rubber were shut off from this country. Cotton fabric, made in various weights, forms the base of the product. The synthetic rubber is forced into the pores of the fabric, and the material is then subjected to a vulcanizing process.

A Notable Salvaging and Reclaiming Job

More than three hundred damaged cast-steel car couplers are being reclaimed and put back into service each month by the Erie Railroad through a new process of welding and normalizing that is being applied at the company's Meadville reclamation plant. The new process was developed after exhaustive research and tests. It has been approved by the Mechanical Division of the Association of American Railroads. Since every unit reclaimed weighs 280 pounds, the reclamation program saves nearly 85,000 pounds of metal every month.

After the welding, the couplers are normalized in an automatic heat-controlled furnace. It is this normalizing that makes the reclaimed material suitable for further use. The furnace is of the car type, 6 feet 6 inches wide by 12 feet long, heated by eight oil burners. The door is 3 feet 6 inches high. Forty-five welded couplers stand vertically on the car floor and fill the oven. The heat is turned on "low" and then gradually brought up to 1600 degrees F., taking two hours to reach this temperature. The heat is held at from 1500 to 1600 degrees F. for one hour and forty-five minutes; it is then shut off and the couplers removed and allowed to cool in still air, free from drafts or rain.

* * *

Trade Restrictions between the States

In a publication called *Trundle Talks*, George T. Trundle, Jr., calls attention to the tendency of many states in the Union to set up trade barriers between the states in the form of tariff duties. Mr. Trundle points out that it seems strange that, although every economist knows what shackles the multiplicity of tariff walls have placed upon economic progress in Europe, we have, nevertheless, begun in this country to build up exactly the same sort of barriers between the various states. This is the more remarkable since the Constitution of the United States is fairly explicit upon the point that the states cannot impose import duties.

Some states have what is known as the "use tax" on equipment that is bought outside of the state. This, of course, is simply another name for a tariff duty. One state imposes a tariff on imports of liquor, and at least one state has made a determined effort to impose a tariff on cigarettes bought in another state. Several states impose a tariff on gasoline when it is carried in the tank of an automobile or truck across the border. These are symptoms of a serious economic disease that is bred by economic ignorance.

Editorial Comment

The one thing for which this war is being fought is to preserve democratic institutions—the rights and the freedom of the individual as against the state. To that end, we must win the war, because our enemies who have destroyed the freedom of the individual in their own countries are bent upon doing the same to all nations that they are able to conquer.

While we are exerting every effort toward the one purpose of winning the war, it is well for us to recognize that our democratic institutions are endangered from inside our own country, as well as from the outside. It is important for us to realize that this attack from the inside is more subtle than that from without, because it is operating under the cloak of freedom. It uses all the names and slogans of freedom, while at the same time, denying to the individual some of his most elementary rights.

Freedom of Enterprise, the First Requisite of a Free People

A prominent business executive recently said: "We need to remind ourselves that political and economic freedom has not shown itself in history to be an especially hardy perennial; it needs special vigilance and care to enable it to thrive." In other words, if industrial employers and employes alike want to continue to carry on their work, upon which the very cornerstone of our civilization rests, with that individual freedom and independence that have characterized the past history of this country, they must be constantly on the alert, resisting the forces that are trying to deprive them of their individual rights and liberties.

The present tendencies toward encroachment on these liberties originate with both Government and labor leaders. Government takes upon itself to deprive business and industry of its age-old natural rights, and Government and labor leaders both prescribe the action that must be followed by the individual worker.

High public officials have already hinted at the continuance of the operation of Government controls of business and industry after the war. Political as well as economic freedom will be only a word, and not a fact, if most people are to be dependent upon a bureaucratic government for their economic existence. After the war, do we want to remain a nation of free men—free to shape our business and work according to our own wishes, so long as we do not encroach upon the equal rights of other men to make their own decisions? Or do we want to be a nation for which all the plans and decisions are made by a central government, the members of which can neither have the knowledge, the ability, nor the broad vision equal to the composite judgment of the millions of men and women who constitute America?

Do We Want to Have Government Bureaus Direct Industry?

* * *

There is much talk about the scarcity of labor and the need for greater production to meet the requirements of the Armed Services. In this connection, it should be pointed out that Government red tape is the cause of a great waste of time and effort on the part of executives and other men holding managerial positions in manufacturing plants throughout the country. Time that could well be devoted to more important problems of management is taken in filling out an endless number of questionnaires and reports requested by the various Government departments, boards, and agencies.

Industry Asks for Less Red Tape and Clear Regulations

Industry also finds itself hampered by Government regulations that are confusing and susceptible of varying interpretation. One example that may be mentioned is the so-called "wage stabilization order." Some manufacturers say that this has created so much confusion that no one actually knows what his rights or limitations are. The order has not controlled increases in prices or wages to any appreciable extent, and therefore has not been very effective in counteracting inflation; but it has created a most difficult wage and salary administration problem. Any attempt to operate conscientiously under not clearly defined regulations takes the time of men who could use their efforts to much better purpose for promoting war production.

How to Secure Fine Surfaces by Grinding

By the Late H. J. WILLS
and H. J. INGRAM, Engineer
The Carborundum Co., Niagara Falls, N. Y.

Seventh of a Series of Articles Covering the Factors that Govern Fine Surface Quality and the Means by which This Quality Can be Obtained—The Present Article Deals with Wheel Truing Operations

THE factors that control or influence the production of fine surface quality by grinding and the methods and equipment employed to insure fine quality surfaces on different materials finished by grinding under quantity production conditions have been discussed in the preceding articles in this series. The discussion is continued in this article, with special consideration of the correct procedure in truing grinding wheels.

While either a diamond or an abrasive wheel can be used for both dressing and truing the face of a grinding wheel that is to be employed in fine grinding, it is important to remember that the two operations of truing and dressing have entirely different aims.

Wheel Dressing and Truing Operations

Dressing is employed for the purpose of changing or restoring the cutting action of the wheel, whereas truing serves to make the wheel face concentric with its mount or spindle, to make the face parallel with the axis, or to form the face to a taper or other contour.

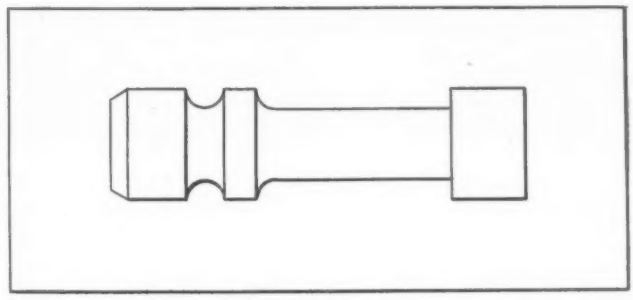


Fig. 1. Part Ground to Irregular Shape in Single Plunge Cut of Wide-faced Wheel Trued to the Required Profile

When a wheel is dressed, it is also to some extent trued. However, a wheel may be perfectly trued for its purpose, and yet the cutting surface may not be properly dressed. When this happens, as it often does, it is necessary to follow the truing with a dressing operation. In truing, as in dressing, it is poor practice to attempt to true a wheel of finer than 220 grit that has developed a taper or has become rounded, by bringing the tool into contact with the wheel either at the side or at the highest part. In such cases, it is preferable to bring the truing tool almost to the highest part of the wheel face and then start the in-feed at 0.001 inch per pass. This will prevent gouging, wheel marks, and damage to the truing tool.

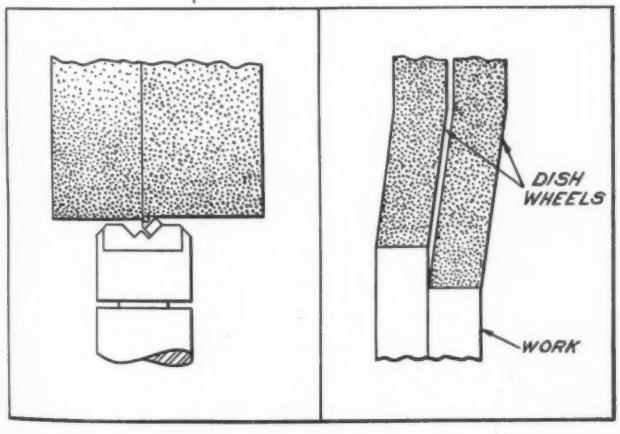


Fig. 2. (Left) Grinding Wheel Contour Truing Tool which Permits Diamond to be Mounted so that it Faces Either to the Right or to the Left. Fig. 3. (Right) Two Dish-shaped Grinding Wheels Arranged for Either Internal or External Corner Grinding

Truing Wheels with and without Coolants

Many of the precautions given for dressing wheels apply equally to truing. Thus, if a grinding wheel is used without coolant, it should be trued without a coolant and vice versa. To prevent scratches caused by particles of abrasive that have been crushed into the wheel face, usually by a diamond that is too dull, the wheel face should be scrubbed, after truing, with a stiff brush, using plenty of water.

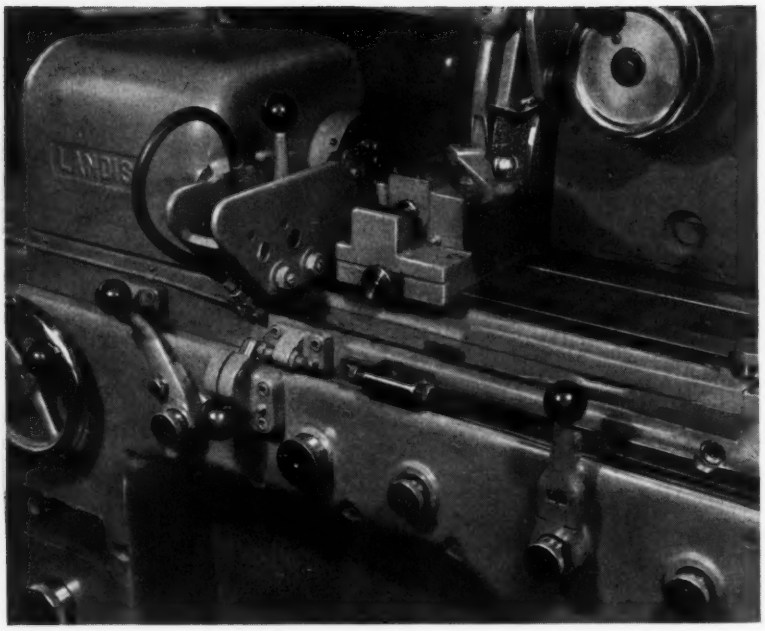


Fig. 4. Set-up for Truing Face of Grinding Wheel to Shape Shown at A, Fig. 10

Wheels should be trued at specified intervals. The truing should be done at the rotative and traversing speeds at which the wheel will operate when grinding. Unless a square corner is to be ground on the work, the wheel should have its edges rounded off with an abrasive stick or diamond, followed by a piece of aluminum-oxide cloth or paper, to avoid a dragging edge effect, to prevent the edges from being chipped, and to eliminate feed lines on the work.

While it is usually necessary to dress the sides of a straight wheel when the sides are used for grinding, as when grinding to a shoulder on a crankshaft, it is undesirable to remove material from the sides of a wheel solely for truing, since this rapidly reduces the thickness of the wheel. A wheel thus reduced in thickness must be discarded while still of the proper diameter, merely because the thickness has been decreased to a point where the production rate is unduly reduced.

Side truing is most likely to be done when forming a radius on the edge of a wheel either to prevent dragging or for use in grinding to a filleted shoulder. It is more economical and equally effective, when the radius becomes too large, to reduce the radius by truing the face of the wheel rather than the sides.

Only sharp diamonds should be used in truing; otherwise the desired cutting effect will not be achieved and faulty surfaces will result. This is especially essential when forming thin edges or sharp corners on wheels used for thread grinding, on wheels for grinding V-shaped contours in work such as sheaves for V-belts, or on the faces of wheels that are to be used for grinding to a shoulder of a shaft in an angular wheel-head.

It is poor practice to use a dull truing diamond on any wheel face, and it may be extremely expensive to use one in this condition on wheels having thin contours, because a dull diamond must be applied with heavy pressure to penetrate the wheel. The pressure thus applied may easily be too great for the thin edge to stand, with the result that the wheel will be chipped or broken.

In truing thin-edged wheels, the best practice is to start the truing cut at the weakest part, which is usually the extreme edge of the periphery, and then continue truing toward the arbor.

In grinding a complicated part like that shown in Fig. 1, it is well to investigate the possibility of doing the work in a single plunge cut with one wide-faced wheel. The part illustrated was ground in this way, a departure from the practice employed until quite recently. Formerly, at least two wheels would have been used, one with a half-round face and one with a square edge and a straight corner.

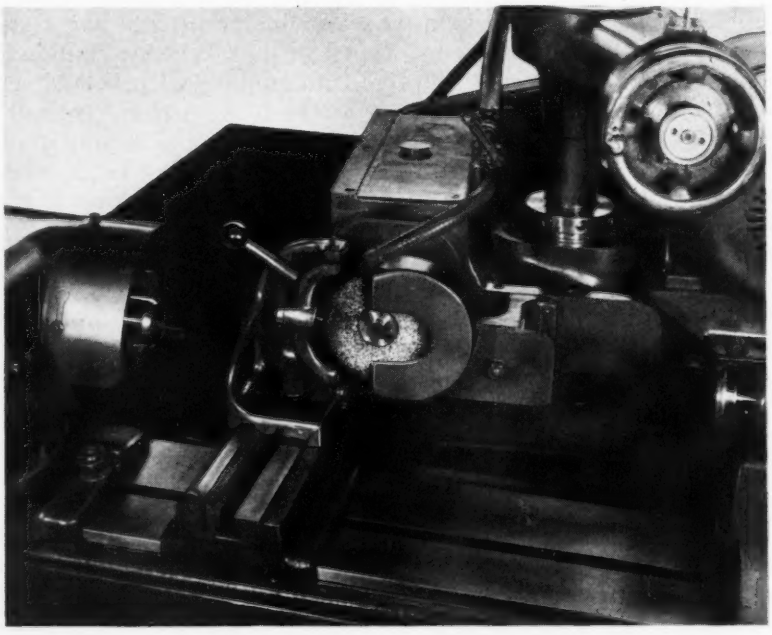
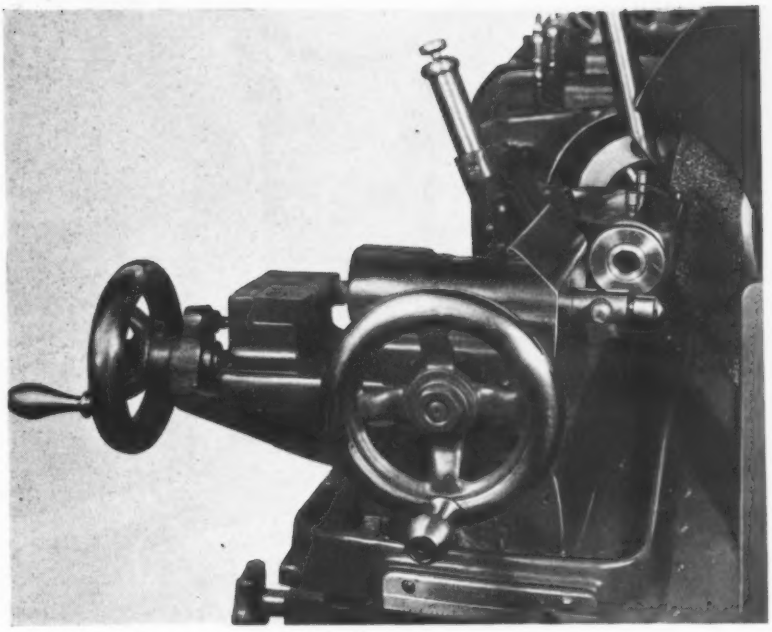


Fig. 5. Truing Device Used to True Grinding Wheel to Shape Shown at B, Fig. 10

Fig. 6. Tool with Two Diamonds Used for Truing Wheel to Shape Seen at C, Fig. 10



The improvement in diamond truing tools during recent years has made feasible the truing of extremely complicated contours on wide-faced wheels. Half-round contours can be ground with standard wheels, which are available in various widths. However, as these wheels wear, it is necessary to true their faces in order to attain the desired contours.

Truing a wheel to form a square inside or internal corner presents no difficulties; but truing a wheel to grind a square outside corner is not so easily accomplished. Several methods and types of tools have been developed for this purpose. In the writers' opinion, however, all of these, with the possible exception of one, have serious disadvantages.

Two of the methods require large expensive diamonds, which must be held in long holders in order to reach into the sharp corner. With both types, the excessive overhang of the holder prevents the tool from being held firmly, and as a result, vibration is more than likely to occur, which may cause the stone to break or, at best, result in an unsatisfactory truing job. With one type of truing tool, it is impossible to turn or reposition the diamond in the holder so that a sharp point or edge will always do the truing. It is necessary to have the stone reset after only a few truings in this type of holder.

A third method employs an expensive tool with a diamond which must be lapped to a square-cornered shape. This truing stone does not tend to vibrate, because it is held firmly close to the wheel. Lapping this type of stone, however, is an expensive operation, and has the disadvantage that the lapping removes the skin or hardest part of the stone, so that the stone wears away more rapidly.

In the writers' opinion, the only satisfactory tool for truing a square inside corner on the wheel is the one shown in Fig. 2, which permits the diamond tool to be mounted in either of two positions, facing to the left or to the right, thus enabling advantage to be taken of the cleavage planes of the diamond in either setting. Another advantage of this tool is that the stone is mounted close to the holder shank; with this arrangement, there is little danger of troublesome vibration.

It is possible to grind outside and inside corners to a sharp edge on external and internal surfaces by means of two wheels arranged as shown in Fig. 3. By using two wheels in this way, no difficulty is experienced in dressing, truing, and setting the wheels for grinding sharp corners. Either two dish-shaped grinding wheels or two straight wheels that have been trued to a slight offset can be used. In either case, only truing of the kind used in straight-wheel work is employed.

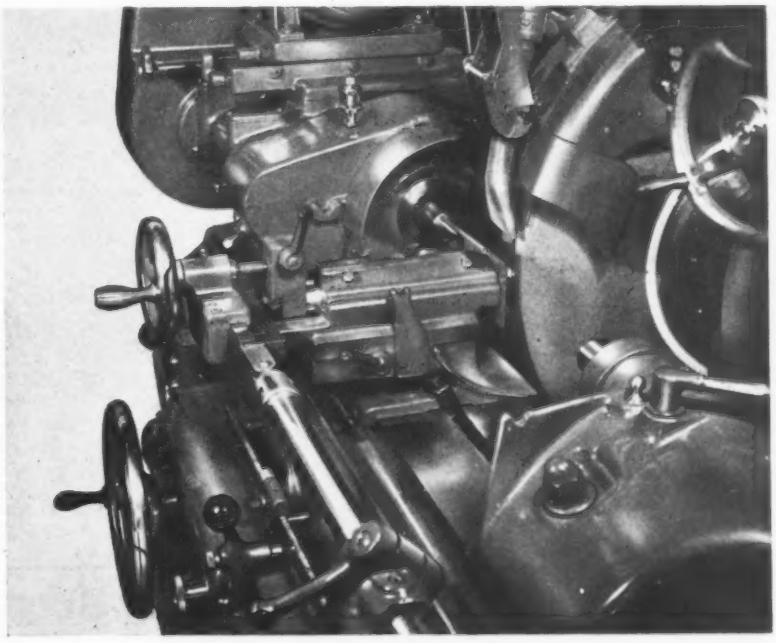


Fig. 7. Truing Equipment for Forming Two Wheels to Contours Shown at D, Fig. 10

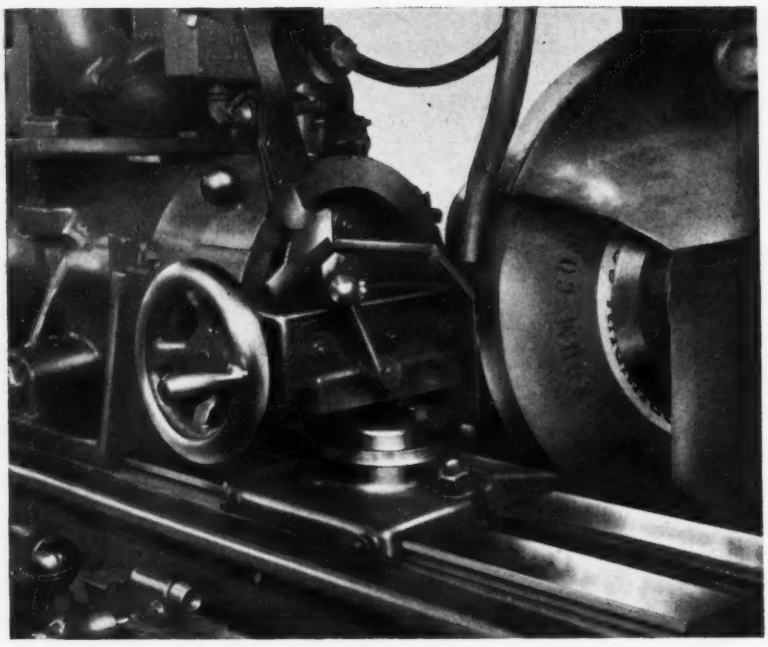
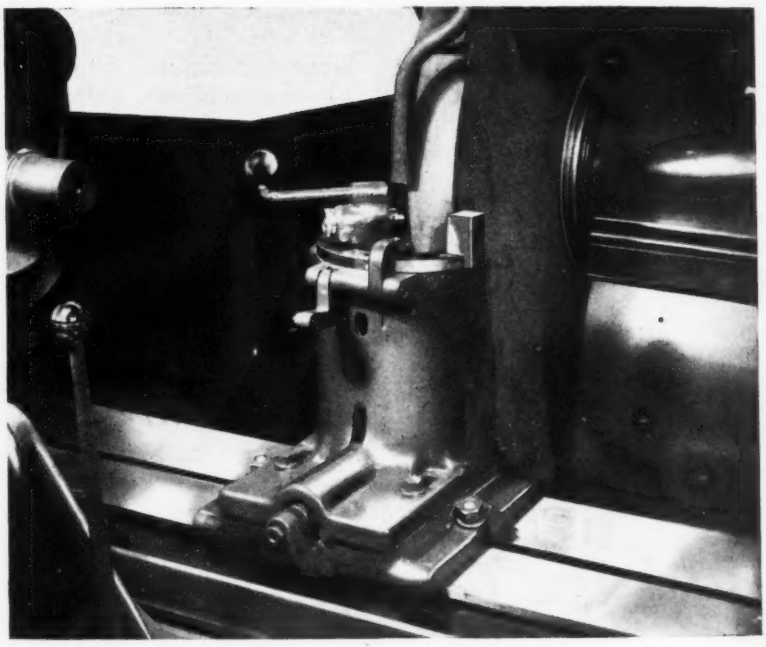


Fig. 8. (Left) Two-wheel Set-up being Trued to Shapes Indicated at E, Fig. 10

Fig. 9. (Below) Set-up Employing Profile Bar for Truing Face of Wheel to Shape Shown at F, Fig. 10

An airplane piston is being relief-ground successfully on the left-hand side of a 12-inch wheel face which is profiled for the relief-grinding operation. The table is then traversed to the right and the right-hand side of the wheel face is used for circle-grinding the piston. The device shown in Fig. 4 is used to true the wheel face to the shape shown at *A*, Fig. 10, for grinding two diameters and a taper. In Fig. 5 is shown a radial truing device

In truing wheels for either convex or concave precision radii grinding it is, of course, essential that the truing be done with a radius truing device. It is also possible to secure specially designed truing devices for forming complicated profiles on wide-faced wheels. By so doing, it is often possible to obtain results from a plain cylindrical grinder that would otherwise call for a special single-purpose machine. For example, a gun manufacturer increased the production of the grinding operation on gun controls tremendously by using a wheel with an 11-inch face on a plain hydraulic grinder, and truing the wide face of the wheel so as to grind eight tapered diameters at the same time.



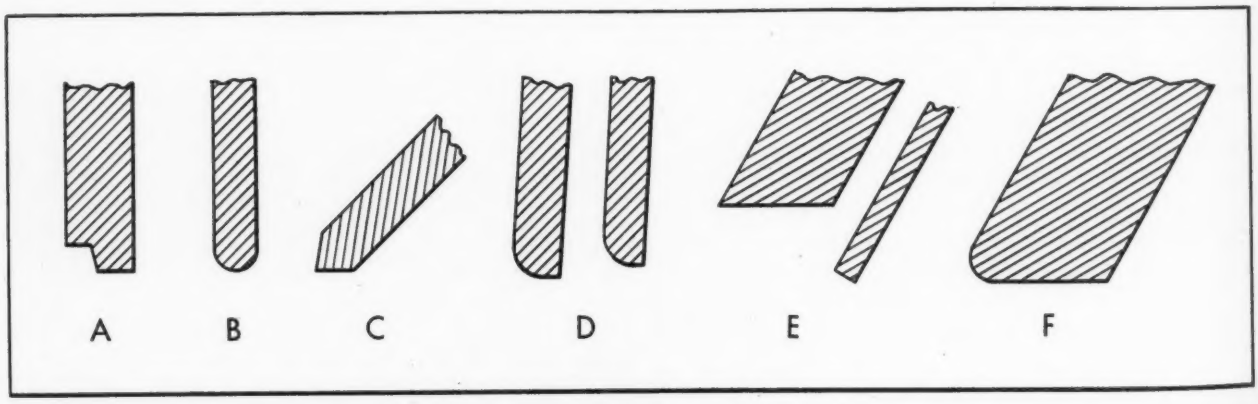


Fig. 10. Profiles of Grinding Wheel Faces Produced by Truing Fixtures Shown in Figs. 4 to 9

used to form the wheel for radius grinding operations on an airplane propeller shaft, as shown at *B*, Fig. 10.

Time is saved in grinding simultaneously the journal and adjacent thrust bearing of a universal spider by employing the wheel shown in Fig. 6. Two diamonds are used in the device employed for truing the wheel used in this operation. One diamond is located at the side of the truing bar and one at the end to provide means for forming a wheel to the shape shown at *C*, Fig. 10.

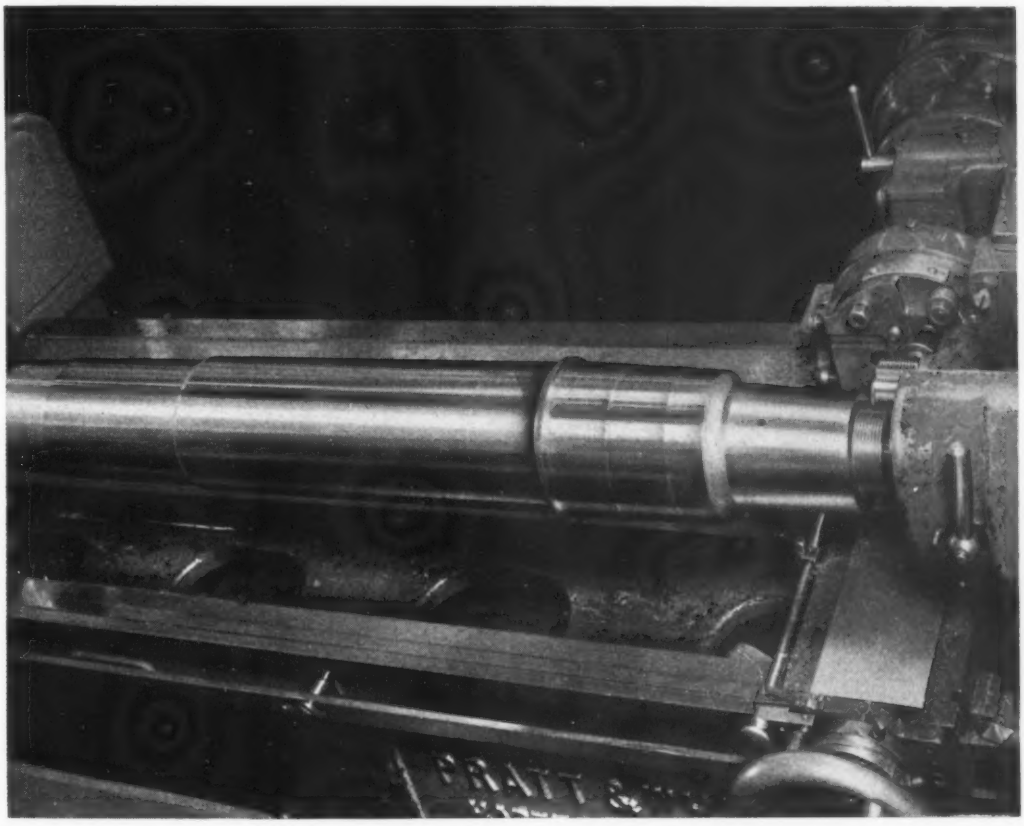
In Fig. 7 is shown the equipment for truing two wheels of different diameters and shapes as shown at *D*, Fig. 10, with a combination profile and right-angle truing device. The forward movement of the device is used in combination with the profile bar.

To grind the cylindrical and tapered surfaces of a small crank used in airplanes to the correct diameter and bevel, it is necessary to use two wheels having the shapes indicated at *E*, Fig. 10. Both wheels are trued by means of the device shown in Fig. 8, which can be swiveled to any required angle.

To form-grind an airplane engine part to a given diameter with radius-formed and shoulder surfaces, the wheel is trued with a device like the one shown in Fig. 9. With this arrangement, the truing diamond is guided by a profile bar in forming the wheel to the shape indicated at *F*, Fig. 10.

A profile bar or cam is usually desirable when it is necessary to form a contour on a wheel face at frequent intervals, since it saves time as compared with the hand-truing method and insures that the form will be accurately reproduced each time. In using this type of truing device, the tool pivot should be kept tight, so as to prevent the wheel from being gouged by the truing tool and insure that the wheel will be formed to the exact contour of the templet.

Milling Threads on One End of an Armature Shaft for the Electric Motor of a Diesel-electric Industrial Locomotive at the Erie Plant of the General Electric Co. The Threads are being Milled to a Diameter of 3 1/8 Inches, Eight Threads per Inch, for a Tight Fitting Pinion Nut. The Operation is Performed on a Pratt & Whitney Thread Milling Machine. The Armature Shaft is Slightly over 4 Feet in Length, and has a Maximum Diameter of 6 Inches



Design of Stampings to Facilitate Production

By RALPH A. WAGNER, Chief Tool Designer
Consolidated Aircraft Corporation, San Diego, Calif.

Detailed Data on the Design of Stampings for Quantity Production, Types of Stampings Made, Materials Used, and Die Design Suggestions—Third Article of a Series

IN the first installment of this series of articles, published in September MACHINERY, the broad classifications of stampings were reviewed and an outline was given of the kinds of materials generally used for stampings. The second installment, published in October MACHINERY, covered details of stamping design. The present article continues the discussion of this subject.

Drawn or Formed Notched Parts

When notches are required in stampings, they should be so designed as to eliminate additional operations, in order to simplify manufacture. Since in drawn or formed parts the metal flows to such an extent that any notch put into the blank or sheet before drawing or forming may cause the stamping to break, tear, or distort, it is usually better not to notch until after the stamping is completely drawn or formed. There are, of course, exceptions, depending on the design of the stamping and on the location of the notches.

If the notches are close to the edges of the flanges and are not in the drawn portion, a die can be built to notch and trim while the piece is in the shape it assumes as a result of the first draw (see Fig. 30). Then it can be notched and trimmed, as indicated in Fig. 31. This operation is followed by a redraw to give the piece the required depth and to bring the notches in the flanges into the required position, as in Fig. 32.

In such cases, developments and try-outs to insure the correct final notch location usually have to be made to allow for metal flow, as the metal flow is not always predictable, depending upon the shape and character of the drawn part. Designers who are not familiar with practice of this kind should discuss the design with the stamping manufacturer and try to locate notches and holes in such positions that extra operations and extra dies—such as may be required if the notches or holes have to be made after the final draw—are avoided.

Notches in straight channels, angles, curls, double folds, or bends can be put in by two methods. In the first, which is most generally used, notching is done "in the flat," as indicated in Fig. 33. The material is usually sheared to size, if the edges are square, and then notched; if holes are required, it is pierced, after which bending, forming, or folding operations are performed.

For large quantity production, where extra die cost is offset by reducing the number of individual notching, trimming, or perforating operations, dies are designed to combine as many of these flat sheet operations as possible; but for small quantity production, where a high die cost is not justified, the designer should consider the shape and size of the notches required with regard to some fabricating company's standard dies. This may require more operations to manufacture the stampings, raising the piece price slightly, but it keeps the die cost for notching at a minimum.

In designing for this type of production, the notches and holes should be kept well away from any bend lines, if possible. At the edge of the piece and away from bend lines, notches may not be affected by the forming; but any holes or notches that are near the bends (Figs. 34 and 35) may cause weakness at these points, and result in bent or distorted flanges, or in holes or notches that are distorted. Tolerances of not less than 1/64 to 1/32 inch should be specified to allow for variations in the location of holes and notches in formed parts, as there are bound to be variations which are difficult or impossible to hold within narrower limits.

The second method—notching after forming—is a more accurate one, but usually involves greater die cost. If notches are required to run through the bend line of a formed stamping, the latter is set up on an angle, as in Fig. 35, and both flanges are notched in one operation. This, of course, cuts the edges of the notch at an angle to the flanges—that is, parallel to the motion of the punch—and an allowance may have to be made to provide clearance for any unit to be assembled where the notches come.

When a notch comes at a corner or a corner

has to be sheared off at the edge of a bend, as in an angle or a channel, Fig. 36, true forming is difficult, as the metal tends to pucker at the bend, especially if heavy gage metal is used and if the forming is done after shearing or notching. In such cases, it is much better to keep the notch or shear line away from the bend, as in Fig. 37, or to form before shearing. The shear or notch is preferably kept beyond the point where the radius of the bend starts.

Sometimes drawings show the shear or notch in such position as to leave a mitered edge throughout the thickness of the material, even though this may not be necessary. In this case, the estimator has to figure on machining the edge (at considerably increased and perhaps unnecessary extra cost), as shearing at an angle is not feasible.

Holes are pierced in stampings by one or more of the following methods:

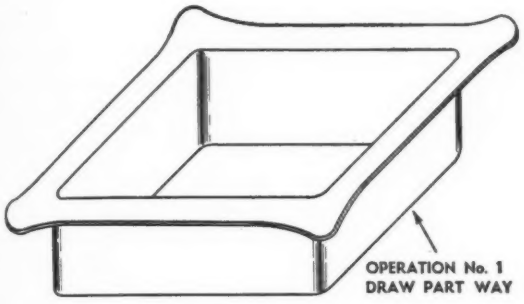


FIG. 30

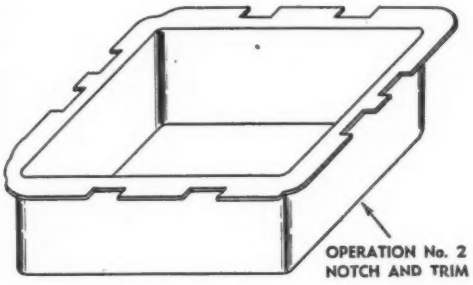


FIG. 31

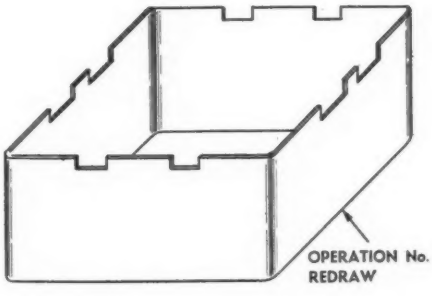


FIG. 32

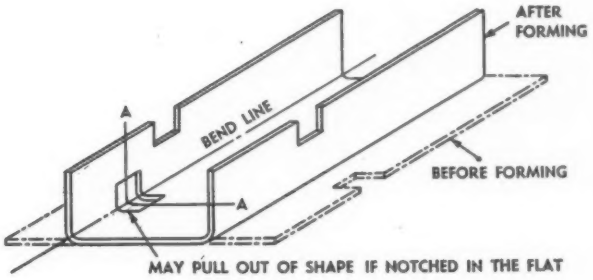


FIG. 33

FIG. 34

FIG. 35

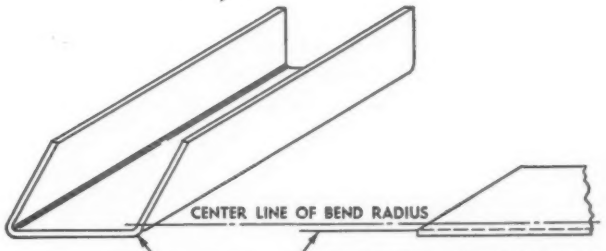


FIG. 36

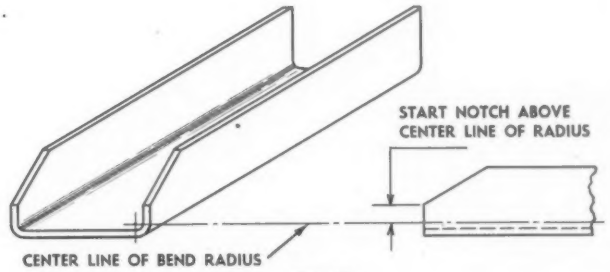
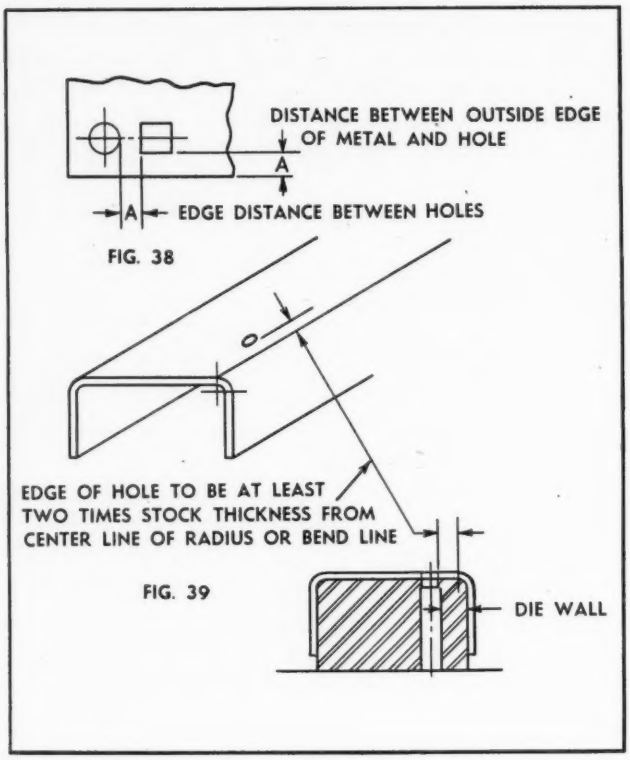


FIG. 37

Fig. 30. Appearance of Part after First Draw. Fig. 31. Appearance of Part after it is Notched and Trimmed. Fig. 32. Final Appearance of Part after it has been Redrawn to the Required Depth. Fig. 33. Notching "in the Flat" and Bending afterward. Figs. 34 and 35. Holes Located at a Bend are Generally to be Avoided; but when Required, the Formed Stamping may be Set at an Angle, as in Fig. 35, for Notching. Fig. 36. If Possible, Metal should Not be Sheared off at an Angle to the Bottom of a Channel; it is Better to Notch as Shown in Fig. 37


DISTANCE BETWEEN OUTSIDE EDGE OF METAL AND HOLE
A
A
EDGE DISTANCE BETWEEN HOLES
FIG. 38
EDGE OF HOLE TO BE AT LEAST TWO TIMES STOCK THICKNESS FROM CENTER LINE OF RADIUS OR BEND LINE
FIG. 39
DIE WALL

Figs. 38 and 39. Illustrations Showing Minimum Distance that Holes Should be Located from Edges or Bends

(a) Perforating in the flat, in conjunction with blanking. This is known as "blanking and perforating."

(b) Perforating in flat square-sheared blanks, which may or may not be formed later.

(c) Perforating after the stamping is completely formed or drawn.

(d) Perforating in conjunction with trimming, commonly termed a "perforating and trimming" operation.

(e) Drop-punch method, which usually involves using a jig made of strap steel, welded or screwed securely together with bushings of the correct hole size, properly located. The jig is made to fit around the blank, which is clamped in place. It is then placed over a stock die unit having a punch arranged to drop into the bushing of the jig, which locates the punch before the press is tripped and the hole perforated. One hole is perforated at a time.

(f) Another method of perforating one hole at a time is sometimes applied in light gage metal that has undergone a drawing or forming operation, during which locating "blisters" or indentations are made in those positions where the punch is subsequently to perforate a hole. A pin or finder having a cone-shaped insert is arranged to locate the metal protrusions which act as "finders" for the hole centers. The centers are placed over an inverted punch having a tip to match the finder, and when the hole is perforated, the slug moves upward into the die and finally finds its way into a container. No jig is required.

Although these methods of piercing holes do not directly concern the designer of the stamping, a knowledge of them may well affect over-all costs, since the die cost is affected by the method chosen. When no die is required or a stock die can be used, die costs may be lowered, but over-all cost may not be decreased, as the process may be slower than when a special die is employed.

Obviously, the first and fourth methods, (a) and (d), are lowest in cost, since the perforating is combined with other operations that are essential to the manufacture of the product; but such combination operations are not always feasible because of the nature of the stamping.

Locating Holes in Designing Stampings

In designing stampings, the following points should be considered in locating holes, determining sizes of holes, and establishing limits, especially for large quantity production, low piece-price, and low tooling cost:

The distance between the outside of a hole and the outside edge of the stamping or the distance between the edges of two holes on 16-gage and heavier metal should be at least two times the stock thickness of the material used (see Fig. 38). For metal under 16 gage, this distance should not be less than 1/8 inch. These rules apply whether the part is to be perforated before or after forming. If the holes are closer than noted, the wall thickness of the die between the holes may not be sufficient to stand the pressure applied to perform the piercing in one operation. To insure against excessive die maintenance, additional operations in a second die may have to be added.

When holes are put into a stamping, the bend lines and the radii at each side of them should always be considered, whether perforating is done before or after forming. Metal flows at bends, the outside stretching and the inside being compressed; hence, holes should be kept as far away as possible from any bend if stretching or distortion of the hole while forming is to be avoided. When perforating is done after forming, it is always better to gage from the inside of the metal. If the edge of the hole is at least twice the stock thickness away from a line through the center of the radius of the bend, as in Fig. 39, this provides enough wall thickness between the edge of the hole and the edge of the die.

Pierced holes having a diameter less than the stock thickness should not be specified. If holes are less than the stock thickness, they usually have to be drilled, and drilling is much more

expensive than perforating. Hole diameters can be held fairly accurate on the punch side. On the die side, the diameter is slightly greater, because of the clearance allowed between the punch and the die.

Hole diameters are determined in part by the use to which the hole is intended. If the hole is for a cold rivet, 1/64 inch clearance over the nominal rivet size is generally allowed. The clearance for a bolt is between 1/64 and 1/32 inch, as a rule, but for aircraft work the clearance is much less. A tolerance of at least 0.010 inch (plus or minus 0.005 inch) should be allowed in specifying the distance between hole centers.

When bolts are to be used in an assembly where close fits are not required and where variations in center distances are not important or are difficult to control, it is good practice to use holes in one piece and slots or larger holes in the mating stamping, provided the parts are not stressed; this facilitates assembly and decreases costs, because less care is required in holding center distances and less die maintenance is needed.

Extruded Holes in Stampings

Extruded holes are those in which the punch does not shear away the metal, but pushes it outward, so as to form an integral flange or collar around the hole. The interior length of an extruded hole is considerably greater than the metal thickness, and can be made several times as great. This type of hole is used for any of the following purposes, in materials of 5/16-inch gage or greater:

(a) For screw threads, Fig. 40.

(b) To fit pins, bolts, studs, shafts, or bushings, Fig. 41.

(c) For countersunk screw or rivet heads, Fig. 42.

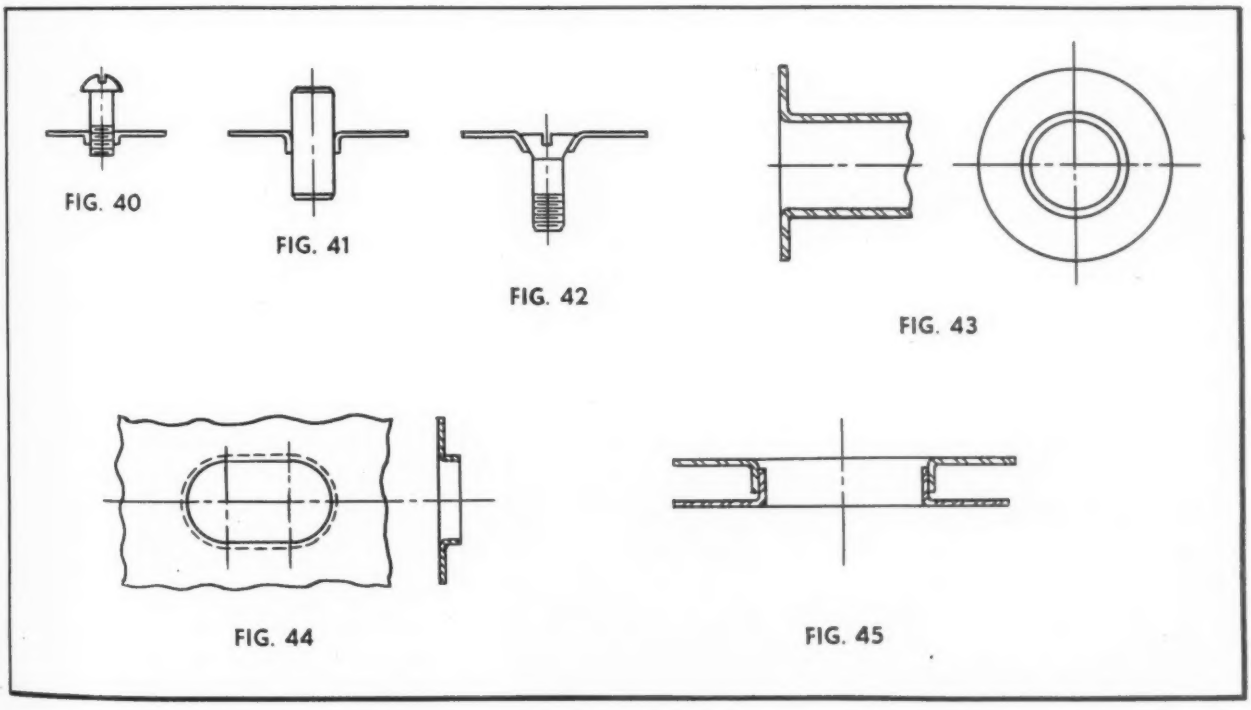
(d) For butt-welding, brazing, or soldering tubes or shafts to a part, Fig. 43.

(e) For clearance holes and lightening holes, especially where stiffening or added strength is required around the hole, as in Fig. 44. Such holes can be of almost any shape that does not involve sharp corners.

(f) For other parts to slip into when assemblies are made, Fig. 45.

In designing such holes, it should be considered how high a flange is necessary and where the metal to be extruded or flanged is coming from. Ordinarily, metal can come only from the area inside the hole; but if the metal required for the flange is too great to come from the center, it has to be drawn in from the area around the hole by means of one or more "pocketing" operations before punching out the center and flanging.

The operation of extruding a hole usually involves first punching out the center and then flanging. Sometimes a single operation both perforates and extrudes, depending on the gage of the material, the size of the hole, and the



Figs. 40, 41, and 42. Extruded Holes for Different Purposes. Fig. 43. Flanging for Butt-welding, Brazing, or Soldering Tubes or Shafts to a Part. Fig. 44. Extruded Hole for Clearance or for Lightening the Metal. Fig. 45. Holes Extruded for Assembly Purposes

height of the flange. This works out satisfactorily for light-gage metal on types of holes such as those shown in Figs. 40 to 42.

The inside diameter of the extruded hole can be held close to size, but the wall at the raw edge of the flange becomes considerably thinner than the original metal, and sometimes checks or cracks. This may or may not be objectionable, depending upon the particular application. If it is essential to thicken the wall, as is sometimes necessary for tapping certain threads, this can be accomplished by extruding the flange higher than required, and then stoving back the metal, to yield, within certain limits, the desired wall thickness. Such stoving can be done cold, if the metal is not too heavy and press equipment of proper tonnage is available. Sometimes hot operations are required. Usually, cracks or checks can be eliminated by reaming after punching, if the hole is round.

The procedure that should be followed in designing an extruded hole for economical manufacture and tooling is first to determine the size of the hole required, and then arrive at the minimum flange height that can be used. Next, the areas should be checked to ascertain whether the metal required will come out of the center and still allow stock thickness around the perforated hole, as shown in Fig. 46. If the area of the extrusion (equal to the area of a cylinder *A* and that of one-fourth of an annular ring *B*) exceeds the area of circle *E*, and the drawing of metal from the outside is necessary, much extra tooling is required and greater development expense is often involved.

Lanced holes are formed by shearing the metal part way around the periphery and then bending the metal adjacent to that sheared. A tab, as in Fig. 47, is sheared on three sides and bent outward on the fourth side, forming a pro-

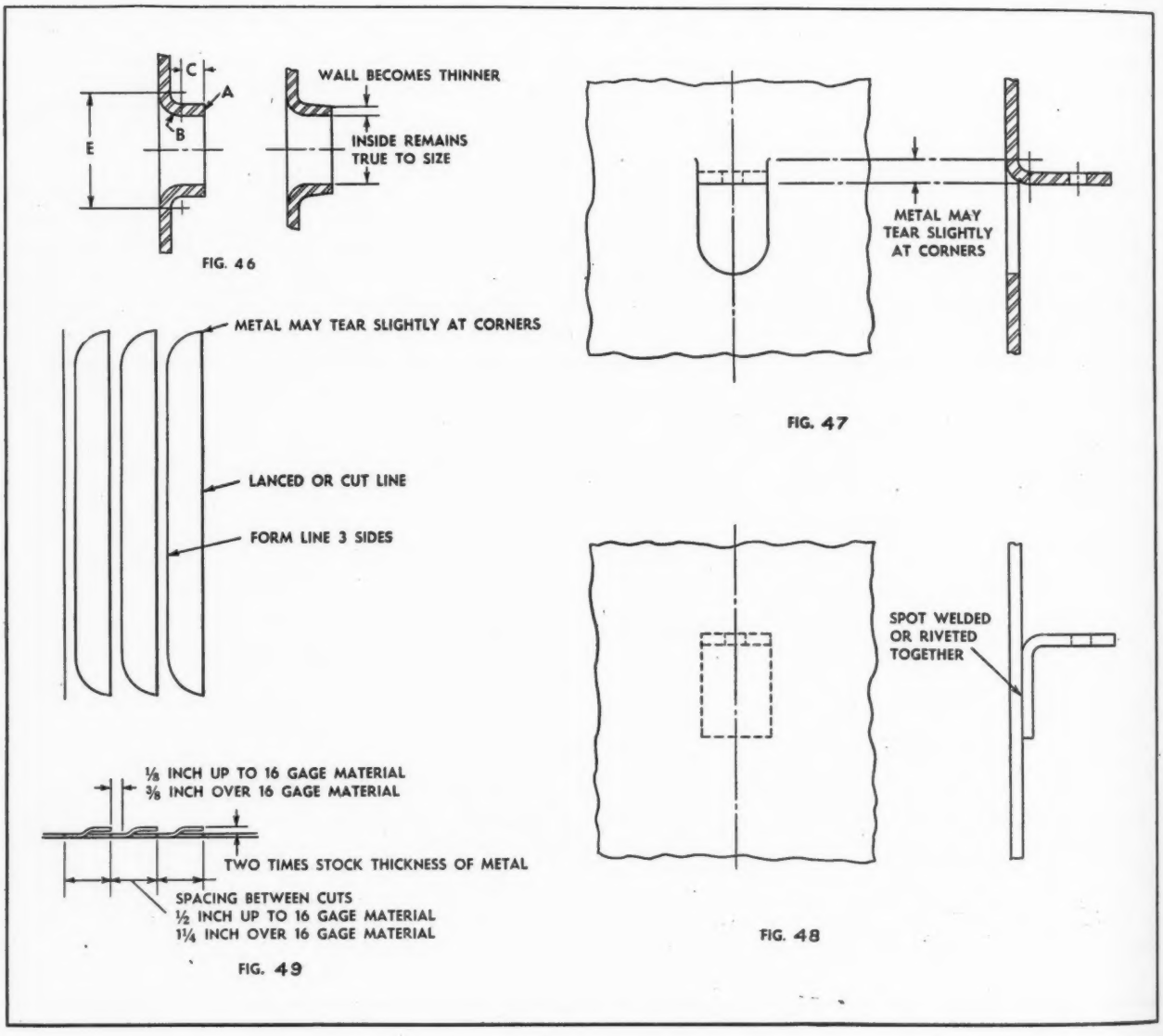


Fig. 46. Illustrations Indicating How to Design Extruded Holes. Fig. 47. Lancing to Obtain a Metal Tab, Making Unnecessary an Attached Piece, as in Fig. 48. Fig. 49. Louvers in Stampings

jection at an angle, but integral with the original metal. Often the center of the projecting portion has a hole perforated in it for a wire, screw, or other fastening. Projections of this type are frequently used instead of attaching another small piece bent at an angle to the stamping, as in Fig. 48.

Lancing and bending is much less expensive than to form a separate piece and weld or attach it by other means, but the hole may weaken the stamping and may afford a less attractive appearance than the alternative. A lanced hole and tab can be produced in one operation; in that case, the metal will have a clean sheared edge on three sides up to the points where the bend starts, but beyond, where the cutting edges of the punch and die end at the bending radius, the metal will tear slightly, because the bending is done before the cutting punch completes its stroke.

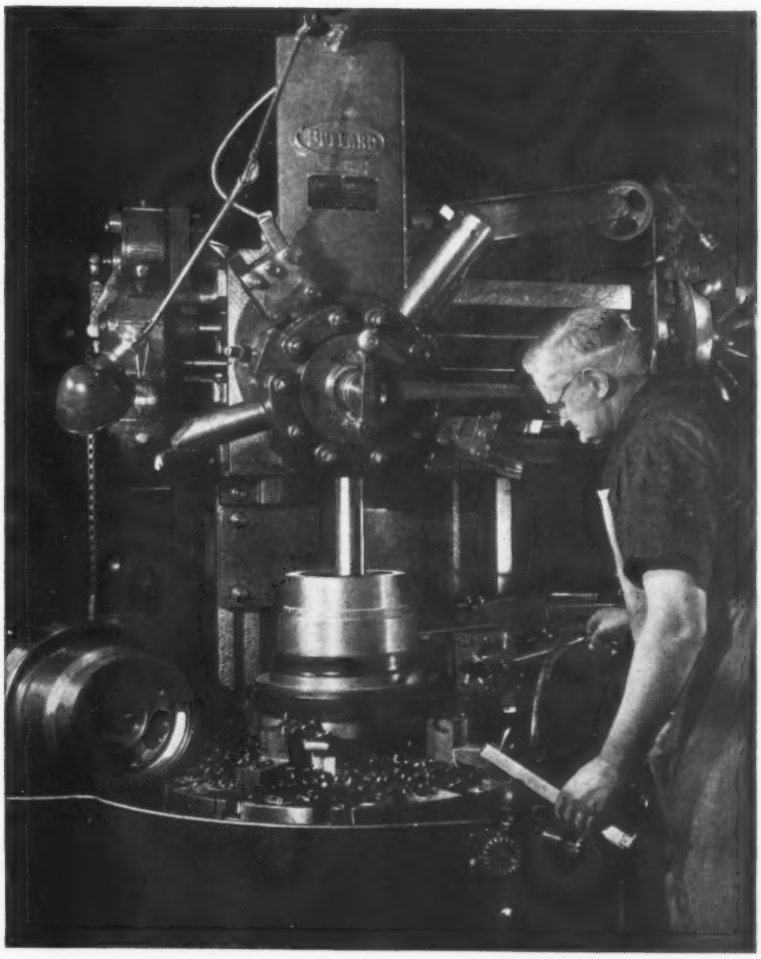
Louvers are usually lanced and formed in one operation. They are commonly formed on three sides and lanced on the other. The two ends of the louver are bent and stretched adjacent to the lanced edge. Louvers are most commonly used for vents, but finger lifts, shelf rests, separators, or card pockets are formed in the same manner. Louvers can be lanced and formed either one at a time or in groups, but the forming should not be too deep, as the metal at the ends is likely to tear severely, producing an unsightly appearance.

On light-gage material, better louvers are formed if cuts are spaced not less than 1/2 inch apart, with a flat extending 1/8 inch from each cut, as in Fig. 49. On material over 16 gage, it is better to allow 1 1/4 inches minimum between cuts, with a flat 3/8 inch from each cut. The length of the louvers is usually from 4 to 6 inches, but can be much greater. The depth from the outside of the louver lip to the face of the blank is preferably not over twice the thickness of the stock. When spaced in rows, good tooling requires that at least 1 inch should be allowed between rows and that lancing should not come closer than 1 inch to the edge.

Machining Commutator Bushings on a Turret Lathe

A BULLARD turret lathe set up at the plant of the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., for the complete machining of commutator bushings for the motors of electric locomotives is shown in the illustration. These bushings have a straight bore 5 inches in diameter in the center of the casting, which is roughed and finished, and also a large-diameter bore which is threaded on the same machine after being finish-bored. Various turning cuts are taken on the outside, including the machining of a vee, which is cut into the upper side of the large-diameter shoulder. This vee is also polished, ready to receive mica insulation.

Roughing cuts are taken to a depth of 3/8 inch with high-speed steel cutting tools. The 5-inch bore must be machined to size within plus or minus 0.0005 inch, and one of the external diameters on which a ring is later fitted must also be finished to the specified dimension within this close tolerance. The large bore in 9 1/2 inches in diamter, and is threaded eight threads per inch.



Materials of Industry

THE PROPERTIES AND NEW APPLICATIONS OF MATERIALS USED IN THE MECHANICAL INDUSTRIES

Boron Carbide Utilized in Gage Devices

Boron carbide manufactured by the Norton Co., Worcester, Mass., under the trade name "Norbide" is being used extensively in the form of molded shapes to provide hard, wear-resistant surfaces in gages of various types. These Norbide molded shapes are furnished in both solid and hollow cylindrical form. The smallest diameter solid cylinder produced is 3/16 inch, with a maximum length of 3/4 inch, while the largest has a diameter of 4 inches and a length of 1 inch. Intervening sizes are made in lengths up to 4 1/2 inches.

They are being used for plug gages, plain and progressive; ring gages; keyway gages; snap gages; micrometers; indicator points; gage-blocks; radius gages; and inserts to provide wearing surfaces for gages, anvils, and parallels. Boron carbide is said to be second in hardness to the diamond, being rated at slightly more than 9 on the Moh scale. 201

Stellite Alloy Useful in Small Mechanisms

An alloy of tungsten, chromium, and cobalt has been placed on the market by the Haynes Stellite Co., Kokomo, Ind., a unit of Union Carbide and Carbon Corporation, in a form adaptable to instrument bearing pivots, phonograph and recording needles, needle valves, and similar applications. This stainless metal is resistant to many corrosive media and all normal atmospheric conditions. At it is not possible to machine it in small parts, these are cast close to size and approximate shape and finished by grinding, and lapping if necessary, to specified diameters.

The properties of this Stellite alloy, according to the manufacturer, include a tensile strength of approximately 65,000 pounds per square inch, a hardness of Rockwell C 60 to 62, high resistance to wear, an unusually low coefficient of friction, the ability to take a high polish, and excellent resistance to corrosion, whether from atmospheric conditions or chemical agents, such as water solutions of various salts, alkalies, and acids. Easily fabricated and virtually non-magnetic, the alloy can readily be brazed or welded to steel or other base metals for use in instruments or mechanisms where non-magnetic, corrosion- and wear-resistant parts are essential. 202

Solvent for Removing Lacquer and Other Protective Coatings

A new solvent has been introduced by the Michigan Chrome & Chemical Co., 6340 E. Jefferson Ave., Detroit, Mich., for the removal of protective coatings manufactured by the company. This material, known as "Miccrostrip," is especially useful for removing lacquer employed to mask parts for hard chromium plating or for selective hardening. Former methods of removal required the use of a knife or wire brush. This new solvent is non-toxic, contains no acids, and therefore will not affect any metal finish. It is actually a combination of solvents, and is used only as a remover and not as a thinner. 203

Compound Facilitates Painting of Galvanized Metal

Permanent paint adhesion on galvanized metal without chipping or peeling can now be obtained by preparing the galvanized surface with Turco Redi-Paint, manufactured by Turco Products, Inc., 6135 S. Central Ave., Los Angeles, Calif. This tends to prevent the paint from peeling or chipping from galvanized metal surfaces because of the smooth spangled surface presented and the alkaline surface condition which is either present at the time of painting or develops subsequently.

Turco Redi-Paint changes the surface of the metal chemically, providing a rough surface to which the paint will adhere with a tight bond. It also neutralizes any alkalinity and makes the metal passive, forming an inactive film which will not become alkaline and which is resistant to corrosion. A helpful feature of the compound

To obtain additional information about materials described on this page, see lower part of page 196.

is that wherever it is applied, a dark tint develops, which can be readily distinguished from any bright untreated areas. 204

Plastic Nameplate Material—A Suitable Substitute for Brass and Bronze

A laminated cellulose acetate plastic material known as "Durashield," which can be fabricated in a wide variety of sizes, shapes, thicknesses, and colors, has been introduced by Plastic Fabricators, Inc., 440 Sansome St., San Francisco, Calif. This material is particularly useful as a substitute for brass and bronze nameplates, dial faces, tool checks, etc., since it can be readily engraved or embossed.

It is already being used for name and instruction plates on ships, machinery, and equipment utilized by the United States Army, Navy, Marine Corps, and Maritime Commission. The product meets the Navy specifications in being fire retardant, and has withstood sustained temperatures ranging from 140 to 200 degrees F. without deteriorating. 205

Gum Solvent for Hydraulic Oil Systems

A gum solvent in concentrated form, which is added to the oil in a machine tool hydraulic system when there is evidence of poor indexing or improper operation, has been developed to obviate flushing and loss of production time. This product, known as Gum Solvent B, is made by E. F. Houghton & Co., 303 W. Lehigh Ave., Philadelphia, Pa.

When used in the small proportions of 3 to 5 per cent of the oil in the system, it puts any accumulation of sludge or gum into solution, so that when the worn oil is later drained, the hydraulic system is left entirely clean. As changing the oil is then only a matter of draining the hydraulic line and refilling with fresh oil, the saving in time is considerable. At the same time, Gum Solvent B is claimed to promote smoother functioning of all hydraulically operated machinery. 206

A New Synthetic Rubber that is Solvent-Resistant

A new synthetic rubber—the sixth major type to be discovered through chemical research—has been developed by the general laboratories of the United States Rubber Co., Rockefeller Center, New York City. This new synthetic, known as "Uskol," will be used in both industrial and household products, and it is expected to take its place beside the present five commercial types of synthetic rubber — Buna S, Buna N, Neoprene, Butyl and Thiokol.

Offering a new high degree of resistance to solvents, this new synthetic will be used in the manufacture of commodities that come into contact with fuels, oils, gasoline, dry-cleaning fluids, and other penetrating chemicals that are the enemies not only of natural rubber, but of other synthetic types. It will also be used for such specialties as industrial molded items, tubing, gas and oil hoses, tank linings, etc. When applied to paper and cardboard it renders them resistant to grease, water, and chemicals. 207

Two-Ply Paper Wrapper Protects Metal Parts

A new grease-proof, non-corrosive paper has been announced by Sherman Paper Products, Newton Upper Falls, Mass., to protect highly finished metal parts against corrosion. This protective wrapping paper, known as V-26, eliminates multiple wrapping operations by combining two protective laminations in one paper. The inner ply provides a grease-proof barrier for the retention of corrosion preventives used on metal products, while a strong outer ply protects the grease-proof inner ply against damage in transit.

Both inner and outer laminations are creped for greater flexibility, and are non-corrosive, consisting of neutral kraft, colored red in accordance with Government specifications for Grade A non-corrosive papers. This paper is available either with an outer film of wax that provides a self-sealing surface or uncoated where this quality is not needed. 208

Flux Suitable for Use with Low Tin-Content Solders

A flux known as "Lloyd's No. 6" soldering fluid, manufactured by the Lloyd S. Johnson Co., 2241 Indiana Ave., Chicago, Ill., has been developed for use with low tin-content solders. This flux is said to have a high enough capillary action to make lead-rich solders flow evenly and completely through solder joints, and provides even higher tensile strength than heretofore obtained with 50-50 solders. The flux is suitable for use with 2 1/2 to 6 per cent silver-lead solders, as well as low-temperature solders, and can be applied in soldering zinc-coated sheet metal (both galvanized and electroplated), lead-coated sheet metal, tinplate, terneplate, brass, copper, steel, and all types of sweat fittings. . 209

To obtain additional information about materials described on this page, see lower part of page 196.

New Trade Literature

RECENT PUBLICATIONS ON MACHINE SHOP EQUIPMENT, UNIT PARTS, AND MATERIALS

To Obtain Copies, Fill in on Form at Bottom of Page 195 the Identifying Number at End of Descriptive Paragraph, or Write Directly to Manufacturer, Mentioning Catalogue Described in the December Number of MACHINERY

Machining of Metals

NATIONAL REFINING CO., Hanna Building, Cleveland 15, Ohio. Booklet entitled "The Machining of Metals," containing technical information on chip formation and machining operations, as well as cutting and soluble oil recommendations for various materials and different classes of operations.....1

Cutter-Rake Checking Device

DETROIT TAP & TOOL CO., 8432 Butler Ave., Detroit 11, Mich. Bulletin HC-43, describing a new universal hook checker for rapidly checking milling cutters, gear hobs, etc., when sharpening, with reference to the correct angle of hook or rake and flute spacing.....2

Cleaning Compounds

OAKITE PRODUCTS, INC., 26 Thames St., New York 6, N. Y. Instruction manual descriptive of Oakite Compound No. 84 and methods of using this compound in cleaning ferrous and non-ferrous parts of deposits that require an acid action for removal.....3

Management Engineering

BEDAUX CO., INC., 6300 Chrysler Bldg., New York City. Booklet entitled "Production Management," briefly describing production management methods employed by this company in approximately 1000 industrial plants in the United States and Canada. 4

Pipe and Tube Bending Handbook

COPPER & BRASS RESEARCH ASSOCIATION, 420 Lexington Ave., New York 17, N. Y. Treatise containing 80 pages showing methods and devices for bending pipes and tubes of copper and its alloys.....5

Ball Bearings

NEW DEPARTURE DIVISION GENERAL MOTORS CORPORATION, Bristol Conn. Booklet WW, entitled "New Departure Keeps 'Em Rolling, Flying, Fighting," outlining the wartime uses for New Departure forged steel ball bearings.....6

Abrasive-Belt Backstand Idler

MATTISON MACHINE WORKS, Rockford, Ill. Circular J-135, on the Mattison abrasive-belt backstand idler, which adapts the regular grinding and polishing lathe to the use of factory-coated abrasive belts. 7

Grinding Wheels

UNIVERSAL WHEEL & ABRASIVE CORPORATION, 2626 W. Van Buren St., Chicago, Ill. Catalogue giving list prices for this company's complete line of grinding wheels, and showing cross-sections of the nine standard types. 8

Hydraulic Machinery

HYDRAULIC MACHINERY, INC., 12825 Ford Road, Dearborn, Mich. Bulletin SM-843, on hydraulic flame-hardening and special machinery. Bulletin PT-845, descriptive of several models of hydraulic presses. 9

Selecting Grinding Wheels

STERLING GRINDING WHEEL DIVISION OF THE CLEVELAND QUARRIES CO., Tiffin, Ohio. Booklet entitled "Sterling Specification Selector" for selecting grinding wheels.....10

Electronic Control for Resistance Welding

GENERAL ELECTRIC CO., Schenectady, N. Y. Treatise GET-1170 (44 pages, 8 1/2 by 10 1/2 inches), entitled "The Fundamentals of Electronic Control for Resistance Welding." 11

Turret Lathes, Automatics, and Balancing Machines

GISHOLT MACHINE CO., 1209 E. Washington Ave., Madison, Wis. Catalogue 1092, covering the entire line of Gisholt machines, including turret lathes, automatic lathes, and balancing machines. 12

Comparator Gaging Equipment

PRATT & WHITNEY DIVISION NILES-BEMENT-POND CO., West Hartford, Conn. Circular 475, descriptive of all types of Pratt & Whitney Electrolimit internal comparators. 13

Diamond Abrasive Wheels

FELKER MFG. CO., 1113 Border St., Torrance, Calif. Catalogue of complete line of Di-Met resinoid-bonded diamond abrasive wheels, made in all standard types up to 6 inches in diameter.....14

Power-Driven Tools

CHARLES L. JARVIS CO., Pease Ave., Middletown, Conn. Catalogue MFT1, covering the Jarvis line of power tools, including flexible-shaft machines, rotary files, and tapping attachments. 15

Mechanical Rubber Products

MANHATTAN RUBBER MFG. DIVISION OF RAYBESTOS-MANHATTAN, INC., Passaic, N. J. Fiftieth anni-

versary catalogue (140 pages) entitled "Manhattan Rubber Products for Industry." 16

Material-Handling Equipment

LYON - RAYMOND CORPORATION, 1378 Madison St., Greene, N. Y. Circular 134, briefly describing Lyon-Raymond hydraulic trucks and hoists, elevating tables, welding positioners, etc. 17

Hacksaw Blades and Band Saws

VICTOR SAW WORKS, INC., Middletown, N. Y. Catalogue 43-V, on Victor hacksaw blades, saw frames, flexible-back band saws, and outline band saws. 18

Variable-Speed Pulley Installations

SPEEDMASTER CO., 1215 Thacker St., Des Plaines, Ill. Engineering manual containing data on the "Speedmaster" — the pulley of a thousand speeds. 19

Roller Bearings

BOWER ROLLER BEARING CO., Detroit, Mich. Bulletin on Bower roller bearings, for which the Ahlberg Bearing Co., 3025 W. 47th St., Chicago, Ill., is the national distributor. 20

Diamond Bonded Wheels

INDUSTRIAL ABRASIVES, INC., 3724 W. 38th St., Chicago 32, Ill. Circular describing a new type of diamond bonded wheel known as "Super-Cut." 21

High-Frequency Induction Heating Equipment

ILLINOIS TOOL WORKS, 2501 N. Keeler Ave., Chicago 39, Ill. Circular descriptive of Illitron, a new method of high-frequency induction heating. 22

Multi-Purpose Grinders

NORTON CO., Worcester 6, Mass. Circular descriptive of the Norton universal multi-purpose grinder for small-lot general production or tool-room work. 23

Variable-Speed Control

REEVES PULLEY CO., Columbus, Ind. Catalogue of 128 pages, 8 1/2 by 11 inches, containing complete information on variable-speed control and drives. 24

Chart for Identifying Carbide Tools

FIRTH-STERLING STEEL CO., McKeesport, Pa. Color chart showing how various grades of Firthite carbide tips are identified by different colors. 25

Boron Carbide

NORTON CO., Worcester 6, Mass. Catalogue descriptive of Norbide boron carbide for gages, gage-blocks, micrometer anvils, and indicator points. 26

Surface Plates and Angle-Irons

BARCO SCRAPING CO., 1975 E. 65th St., Cleveland 3, Ohio. Circular descriptive of Barco hand-scraped surface plates, angle-irons, and straightedges. 27

Micrometers

GEORGE SCHERR CO., INC., 126 Lafayette St., New York 13, N. Y. Folder descriptive of Reed micrometers, now made to measure to 0.0001 inch. 28

Copper-Base Alloys

AMPCO METAL, INC., Milwaukee 4, Wis. Colored chart giving properties and composition of a number of generally used copper-base alloys. 29

Corrosion Prevention

STANDARD STEEL SPRING CO., CORRONIZING DIVISION, Park Bldg., Pittsburgh 22, Pa. Booklet entitled "Corronized for Enduring Protection Against Rust." 30

Motors

FAIRBANKS, MORSE & CO., Chicago, Ill. Bulletin 1160, descriptive of the features of the new Fairbanks-Morse protected polyphase squirrel-cage motor. 31

Hacksaw Blades, Power Saws

CLEMSON BROTHERS, INC., Middletown, N. Y. Catalogue 43-S, on Star hacksaw blades, frames, power saws, and band saws. 32

To Obtain Copies of New Trade Literature

listed on pages 194-196 (without charge or obligation), fill in below the publications wanted, using the identifying number at the end of each descriptive paragraph; detach and mail to:

MACHINERY, 148 Lafayette St., New York 13, N. Y.

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[SEE OTHER SIDE]

Threading Taps

GREENFIELD TAP & DIE CORPORATION, Greenfield, Mass. 16-page booklet entitled "Selecting the Right Tap for the Job." 33

Milling Machines

SUNDSTRAND MACHINE TOOL CO., 2530 Eleventh St., Rockford, Ill. Catalogue on the Model 33 fluid-screw Rigidmil. 34

Coated Abrasive Belts

BEHR-MANNING CORPORATION, DIVISION OF NORTON CO., Troy, N. Y. Folder on Metalite cloth belts for swing-frame grinding. 35

Die-Castings

NEW JERSEY ZINC CO., 160 Front St., New York 7, N. Y. Pamphlet entitled "Factors to be Considered when Designing Die-Castings." 36

Arc-Welding Machines

ALLIS-CHALMERS MFG. CO., Milwaukee, Wis. Bulletin B-6302, on the new Ampac "400" alternating-current arc-welding machine. 37

Pipe Tools

BEAVER PIPE TOOLS, INC., Warren, Ohio. Catalogue 44, covering the complete line of Beaver pipe cutting and threading tools. 38

Profilometers

PHYSICISTS RESEARCH CO., 343 S. Main St., Ann Arbor, Mich. Booklet on Type Q profilometer for measuring surface roughness. 39

Cutting Oils

D. A. STUART OIL CO., 2727 S. Troy St., Chicago 23, Ill. 16-page booklet entitled "The 577th Oil," containing data on coolants and cutting oils. 40

Vises

WESSON PRODUCTS CO., 709 Fisher Bldg., Detroit, Mich. Bulletin on universal vises for angular milling, grinding, and drilling. 41

Oil Filters

WINSLOW ENGINEERING CO., 4069 Hollis St., Oakland, Calif. Booklet on Winslow oil filters and conditioners in industry. 42

Plastic Arbor Spacers

INDUSTRIAL PRODUCTS SUPPLIERS, 2 Broadway, New York 4, N. Y. Folder on Artus spacers for milling machine arbors. 43

Metal-Cleaning Emulsions

ENTHONE CO., New Haven, Conn. Bulletin descriptive of the cleaning of basic metals with emulsion cleaners. 44

Flexible Tubing and Bellows

CHICAGO METAL HOSE CORPORATION, Maywood, Ill. Manual on Rex-Flex stainless-steel flexible tubing and bellows. 45

Hydraulic Surface Grinders

SAVAGE TOOL CO., Savage, Minn. Catalogue of DoAll hydraulic surface grinders and grinder accessories. 46

Universal Joints

DIX MFG. CO., 603 E. 55th St., Los Angeles 11, Calif. 1944 catalogue on aviation type universal joints. 47

Motorized Speed Reducers

FALK CORPORATION, 3001 West Canal St., Milwaukee 8, Wis. Bulletin 3100, descriptive of "Motoreducers." 48

Industrial Trucks

YALE & TOWNE MFG. CO., Philadelphia, Pa. 75-page catalogue on electric industrial trucks 49

* * *

Gear Industry Very Active

The gear manufacturing industry, as represented by the members of the American Gear Manufacturers Association, with headquarters at Empire Bldg., Pittsburgh, Pa., shows an increase of 2.5 per cent in the business booked in September, 1943 (the last month for which complete statistics are available), as compared with August, 1943. In this compilation, turbine or ship propulsion gearing is not included.

To Obtain Additional Information on Shop Equipment

Which of the new or improved equipment described on pages 202-220 is likely to prove advantageous in your shop? To obtain additional information or catalogues about such equipment, fill in below the identifying number found at the end of each description—or write directly to the manufacturer, mentioning machine as described in December, 1943, MACHINERY.

No.	No.	No.	No.	No.	No.	No.	No.	No.	No.

Fill in your name and address on other side of this blank.

To Obtain Additional Information on Materials of Industry

To obtain additional information about any of the materials described on pages 192-193, fill in below the identifying number found at the end of each description—or write directly to the manufacturer, mentioning name of material as described in December, 1943, MACHINERY.

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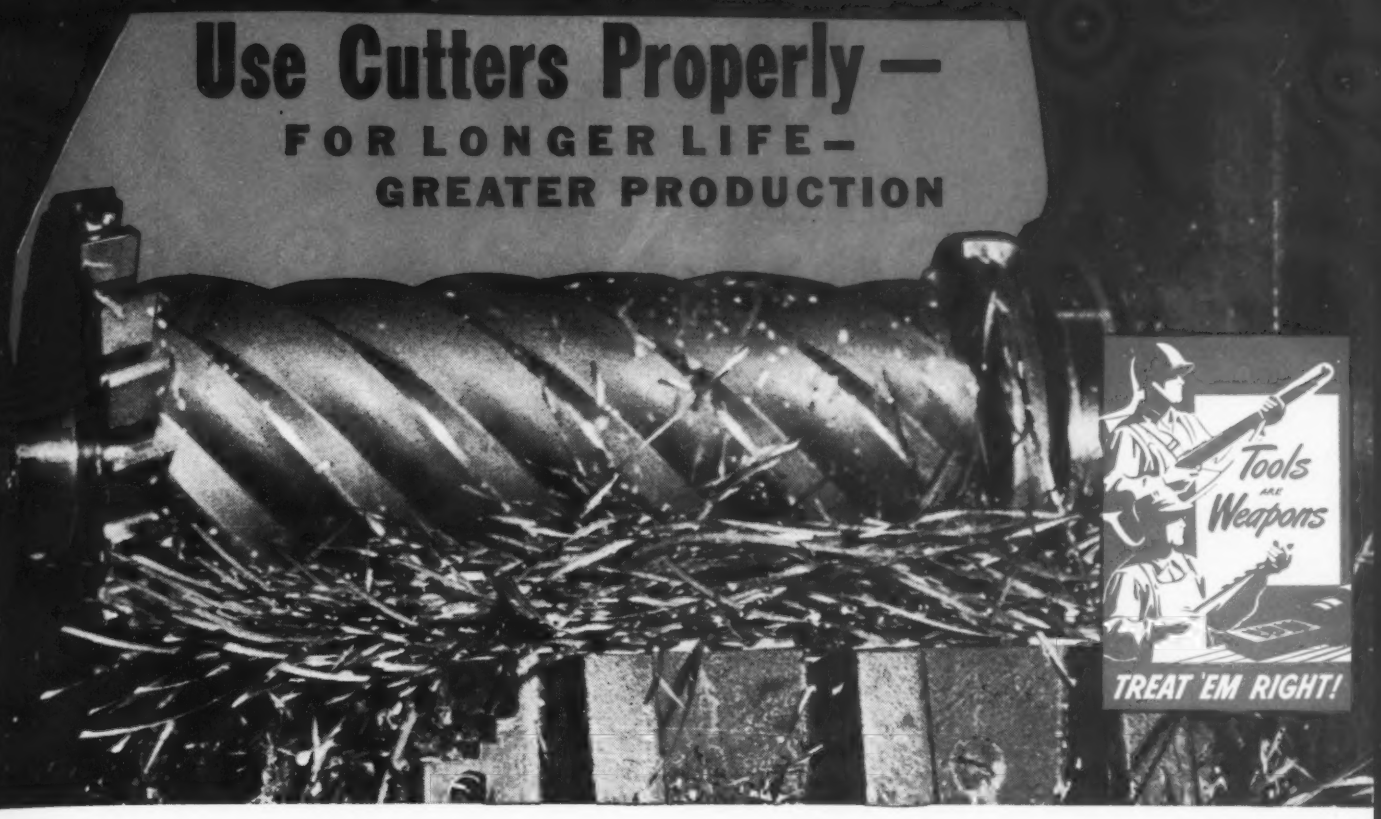
[SEE OTHER SIDE]

Use Cutters Properly—

FOR LONGER LIFE— GREATER PRODUCTION



With high speed steel supplies definitely limited it is a patriotic "must" to use cutters properly so that more may be available for urgent production. Follow the suggestions below. They not only help to get greater production but, most important, swell the national stock pile of milling cutters.

1. Use the proper spindle speed. When changing to a smaller cutter increase the spindle speed.
2. Maintain the correct clearance for the material being machined.
3. Use collars of the same diameter on each side of saws or thin milling cutters. Dissimilar opposed collars may cause distortion and damage the cutters.
4. Be sure shanks of arbors or adapters are clean.
5. Use adequate arbor support.
6. Clamp work securely. Unsuitable clamping may result in premature cutter wear and breakage.
7. Mount cutter as close as practicable to the spindle.
8. Use sharp cutters. Continuing use of a partially dull cutter causes excessive wear.

We are proud to be honored with the Navy "E", awarded for outstanding accomplishment in Defense production.
Brown & Sharpe Mfg. Co.
Providence, R. I., U. S. A.
B&S

The suggestions above can make a marked saving in cutter wear and at the same time increase production. See that every operator or setup man knows these proven methods.

REPRODUCTIONS OF THIS ADVERTISEMENT FOR USE ON YOUR BULLETIN BOARDS FURNISHED ON REQUEST

BROWN & SHARPE CUTTERS

Faster Tool Grinding with Cup-Wheels

By ROGER D. PROSSER
Thomas Prosser & Son, New York

THE advantages of a cup-wheel for grinding carbide, Stellite, high-speed steel, and other hard tools are well recognized. Grinding on the face of a cup-wheel gives a flat clearance, not under-cut as is the case when tools are ground on the periphery of a straight wheel. This is clearly indicated in Fig. 1. The under-cutting gives a much greater clearance than is apparent, and weakens the tool considerably at the most vulnerable point. Fractures of carbide or other hard tools are often attributable to this type of grinding. It is also much easier to obtain a straight accurate cutting edge in grinding on a cup-wheel.

However, rough-grinding on a cup-wheel, where large amounts of material must be removed, does have the disadvantage of being considerably slower than grinding on the periphery of a straight wheel, due to the large area of the wheel in contact with the work, which results in more heating and less free breaking down of the wheel to provide new cutting points. Thus, it is necessary to use a softer wheel and to grind more carefully, in order to avoid overheating and cracking of the tools.

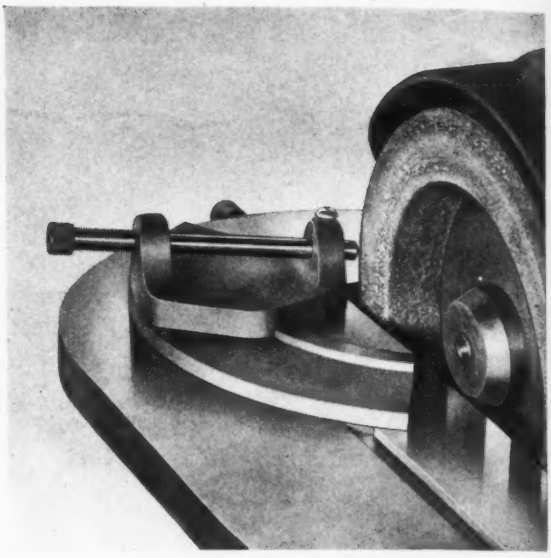


Fig. 4. Radius Dresser for Crowning the Face of Cup-wheel Used for Tool Grinding

The problem is how to retain the advantages of grinding on a cup-wheel and at the same time to overcome the disadvantages. This problem has been solved by slightly crowning the face of the cup-wheel, as shown in Fig. 2. The result is a line contact (instead of surface contact) between the wheel and the work, giving a grinding effect similar to that of grinding on the periphery of a straight wheel, but at the same

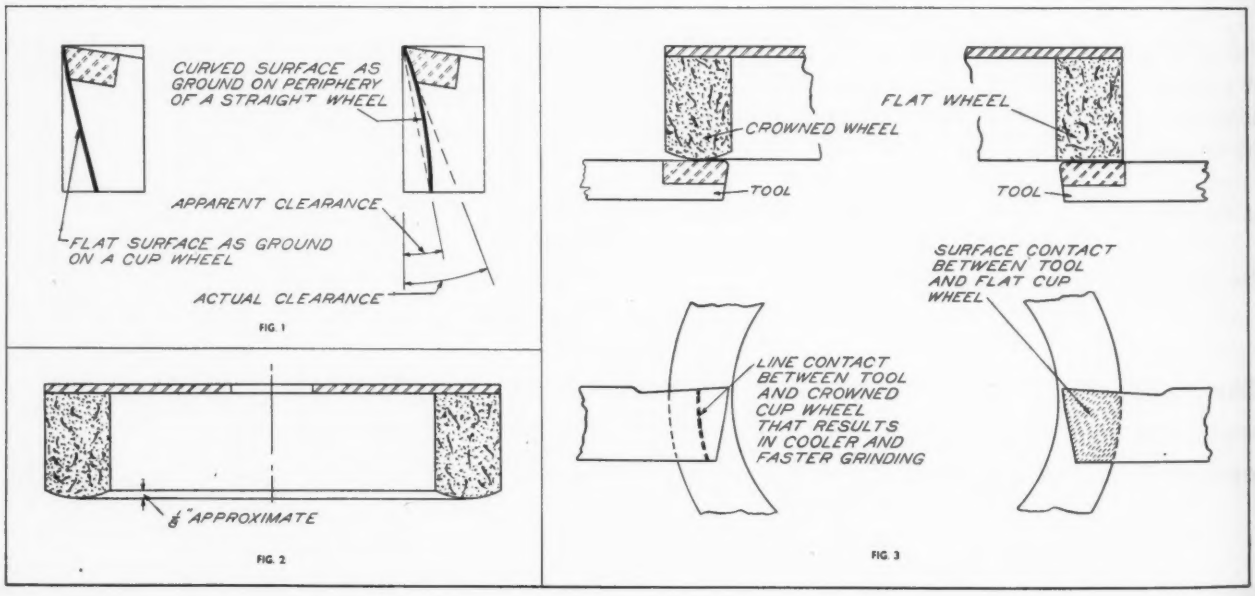
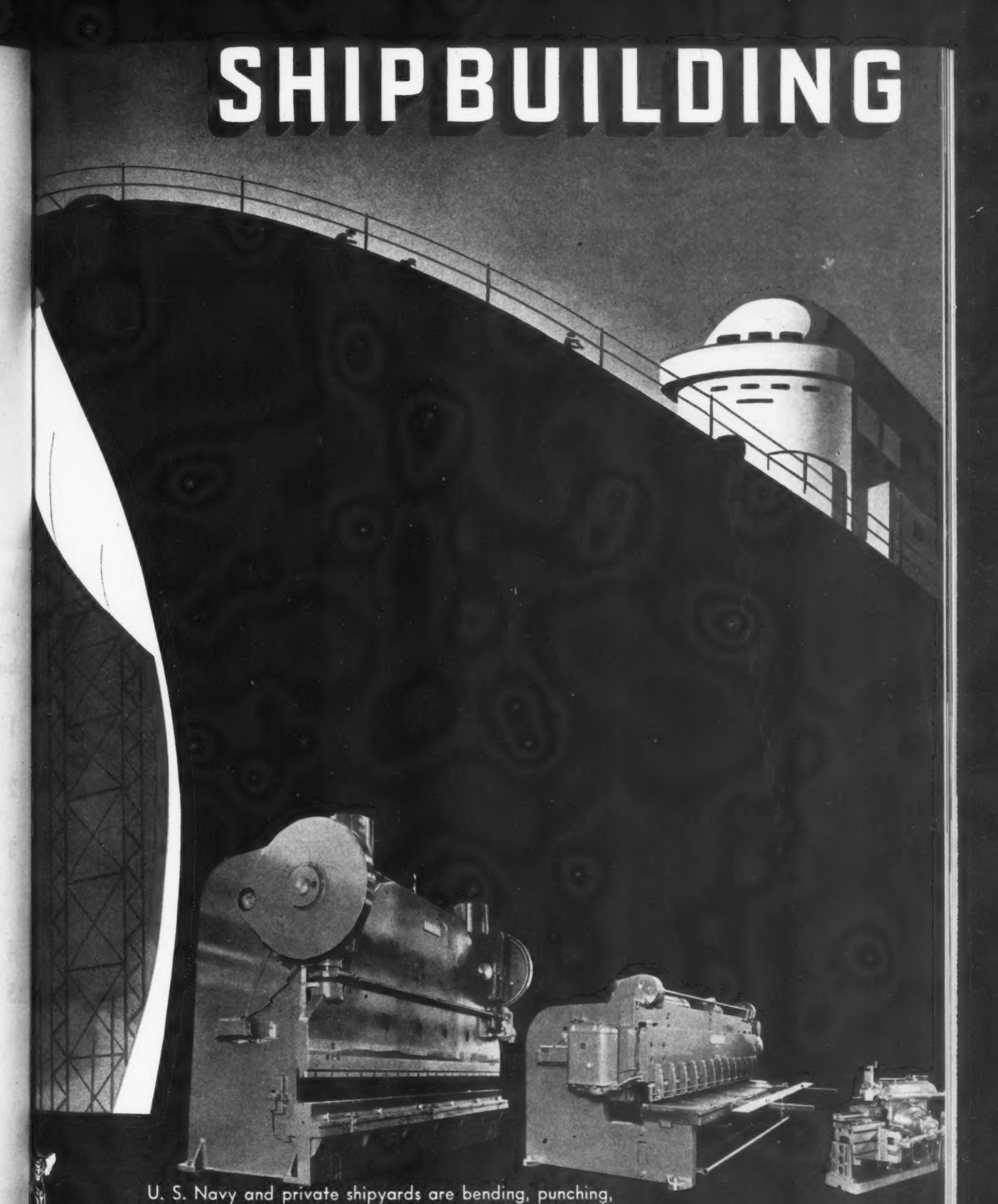

CURVED SURFACE AS GROUND ON PERIPHERY OF A STRAIGHT WHEEL
APPARENT CLEARANCE
FLAT SURFACE AS GROUND ON A CUP WHEEL
ACTUAL CLEARANCE
FIG. 1
1/8" APPROXIMATE
FIG. 2
CROWNED WHEEL
FLAT WHEEL
TOOL
TOOL
SURFACE CONTACT BETWEEN TOOL AND FLAT CUP WHEEL
LINE CONTACT BETWEEN TOOL AND CROWNED CUP WHEEL THAT RESULTS IN COOLER AND FASTER GRINDING
FIG. 3

Fig. 1. Comparison of Tools Ground on Cup-wheels and on Straight Wheels, Indicating Advantage of Grinding on a Cup-wheel and Weakening of Tools Ground on Periphery of Straight Wheel. Fig. 2. Method of Crowning Face of Wheel to Retain Advantages of Cup-wheel Grinding and Overcome Disadvantages. Fig. 3. Comparison of Tool Grinding on Crowned and Flat Cup-wheels

SHIPBUILDING



U. S. Navy and private shipyards are bending, punching, and shearing plate on Cincinnati Press Brakes and Cincinnati Shears. Cincinnati Shapers are working aboard ships as well as in the yards.

Write for Recommendations

THE CINCINNATI SHAPER CO.

SHAPERS · SHEARS · BRAKES

CINCINNATI, OHIO.

time retaining the advantages of cup-wheel grinding, as indicated in Fig. 3.

However, the difficulty involved in crowning the wheel was that there were no suitable fixtures on any grinder on the market, and it was necessary to true the wheel roughly by hand—a rather crude and laborious method, taking more time than was saved in the grinding operation. The problem was somewhat difficult of solution, as the radius point of the crown was within the body of the wheel.

An arrangement was finally devised, as shown in Fig. 4, which quickly produces a slight radius or crown on the face of the wheel. This device can be quickly slipped on the table, the dressing accomplished, and as quickly removed. It has a tongue which slides in the groove on the table, with a pin which drops into a hole in the groove, locating it in such a position that the radius is exactly centered in the face of the wheel. In order to remove the device, it is only necessary to lift it off the table. The entire radius dressing operation, which also trues up the wheel at the same time, takes but a few seconds.

This new method results in much cooler and more rapid grinding of carbide, Stellite, high-speed steel, and other modern cutting tools.

Can We Control Inflation?

WE have been more successful thus far in limiting rises in commodity prices and living costs than we were during the comparable period of the last war, but the fight has not been won.

We have been less successful than either Britain or Canada. Their greater success has been due mainly to the judicious use of subsidies to hold down raw material and food costs, to better control over retail prices and wages, and to heavier taxes on low incomes.

The most severe test of our ability to avoid dangerous inflation lies ahead. Almost half of the 100 per cent increase in living costs that occurred in the United States during and after the last war developed after the end of the war.

Our difficulties in controlling inflation have been due chiefly to "pressure group politics," to mistakes that were made by Government at the beginning of the defense program, and to the failure of Government to prevent a very large excess of effective purchasing power over the supply of available goods and services—probably a $20,000,000,000 annual excess exists at present.

Both farm and labor groups have persistently fought for higher incomes, regardless of the fact that they could be obtained only at the expense of all other groups, and of the facts that the average factory worker now takes home two-thirds more money every week than he took home before the war began, and that the per capita farm income, after all expenses, is 126 per cent above the pre-war average, as contrasted with a 92 per cent increase in the last war.

(According to Government data, the average weekly wage of factory workers was $24.70 in September, 1939, and $41.12 in February, 1943; agricultural net income was $4,300,000,000 in 1939 and $9,700,000,000 in 1942.)

The mistakes made by Government at the beginning of the war and continued for some time thereafter were based upon the wrong assumptions that we could have plenty of both "guns and butter," and that we could assure our national safety without any sacrifice of the "social gains" of the New Deal.—*Stevenson, Jordan & Harrison, Inc.*

* * *

Machine Tool Shipments

According to information released by the War Production Board, machine tool shipments in September—the last month for which complete statistics are available—totaled $84,842,000, compared with $87,405,000 for the month of August. Unfilled orders at the end of September totaled $333,000,000. The net orders received by the industry in September—that is, new orders less cancellations—amounted to $31,759,000. This is at an annual rate of about $380,000,000.

* * *

Modern industrialism has brought certain problems in its wake. Business and management must be given the opportunity—the freedom—to solve these problems. This cannot be done if business and industry are hampered by needless restrictions—nor if the incentives to initiative are destroyed. They cannot do it unless they are allowed to accumulate sufficient reserves for future development and future employment. If we destroy the factors of successful business operation—namely capital, reasonable profit, and freedom from unnecessary restraint—we shall stifle production.—*Eric A. Johnston, President, Chamber of Commerce of the United States*

PROPELLERS

In a well known eastern plant, war orders for Liberty Ship and Tanker propellers required fast retooling. Before a building could be erected for this work, propellers were in production—as attested by this outdoor setup. The machine is an early type Super Service Radial, applied to the drilling and tapping of 12 holes in the hubface. Precision locating from the keyway was specified, and a circular drill jig insured accurate center-to-center distances of all stud holes. Super Service Radials are applied to countless similar precision war jobs, often performing yeoman service 3 shifts per day, 7 days per week. The Super Service Radial's productivity, capacity, adaptability, reliability, accuracy and convenience are features of inestimable value to the war effort. Detailed information upon request. The Cincinnati Bickford Tool Co., Oakley, Cincinnati, Ohio.

SUPER SERVICE RADIAL

Shop Equipment News

Machine Tools, Unit Mechanisms, Machine Parts, and Material-Handling Appliances Recently Placed on the Market

Reed-Prentice Die-Casting and Molding Machines

The Reed-Prentice Corporation, Worcester, Mass., has recently developed two new machines, a 3-G die-casting machine, shown in Fig. 1, and a 10-F plastic molding machine, shown in Fig. 2. The 3-G die-casting machine has a large capacity cold chamber and is equipped with a Vickers 2000-pound pressure hydraulic pump system. The die plates of this machine are 30 by 30 inches, and the clearance between top and bottom frame members is 29 inches. The mold opens 16 inches. The maximum die thickness is 24 inches, and the minimum die thickness is 12 inches. A mold closing pressure of 600 tons is available. This machine is 203 inches long, 64 inches wide, 72 inches high, and weighs 14 tons. A 40-H.P. motor having a speed of 1200 R.P.M. is required to drive the machine, which can be operated manually or semi-automatically.

The new Reed-Prentice 10-F plastic injection molding machine is made in 16- and 22-ounce sizes. These machines are designed for use in handling larger work than the preceding models. New features have been incorporated to assure rapid, continuous, and precision performance. Heavy steel plates are used for the stressed members of the machine. The mold adjustment is controlled by a push-button. A new mold locking mechanism provides a clamping pressure of 600 tons, and has a 16-inch movement that is independent of the mold thickness. The stroke can be shortened for operating thin molds. The die plates slide on hardened and ground steel ways, and all moving parts are automatically lubricated.

The heating cylinder is held by a clamping ring mounted on rails to facilitate removal. The die plates are so arranged that automatic ejection is provided at the center and at the four corners. Movement of the die plate and plunger is controlled automatically by a new timing panel. Manual operation can be employed any time, and both the die plate and plunger can be stopped in any position. The water cooling system for the molds is built in.

The hopper slide capacity of the 16-ounce machine is 64 cubic inches and the molding capacity 22 cubic inches per shot, or 16 ounces. The maximum number of shots per hour, varying with the type of product, ranges up to 180. The pressure exerted on the material by the regular machine is 27,000 pounds, but the machine can be furnished for higher pressures. The total pressure on the injection plunger is 226,000 pounds. The injection plunger has a stroke of 13 inches and operates at a speed of 120 inches per minute. The maximum die height is 20 inches, and the minimum die height 8 inches.

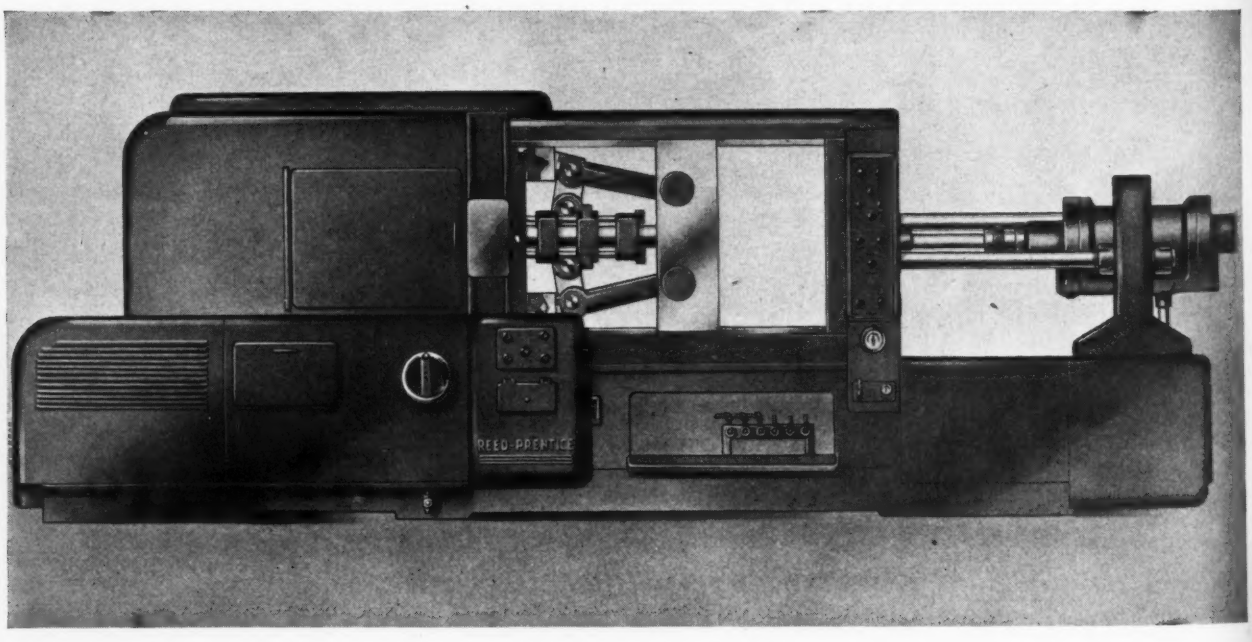


Fig. 1. Die-casting Machine Recently Developed by Reed-Prentice Corporation

To obtain additional information on equipment described on this page, see lower part of page 196.

MANY industries depend upon EX-CELL-O Precision Thread Grinders for production of accurately threaded hardened parts for war work. Outstanding is the aircraft industry. Aircraft engine manufacturers in the United States are using precision thread grinders for threading parts such as cylinder barrels, crankshafts, propeller shafts, crankshaft bearing bolts, connecting rod bolts, tappet adjusting screws, etc. . . . EX-CELL-O precision thread grinders are so dependable that what formerly would have been considered very delicate threading operations on aircraft engine parts are now handled easily, with assured accuracy, high finish, production. . . . EX-CELL-O precision thread grinders grind fine threads directly from heat-treated blanks and finish grind coarser threads after heat treatment.

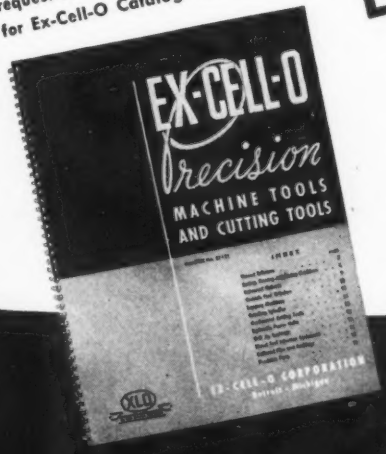
EX-CELL-O CORPORATION • DETROIT

Below: Ex-Cell-O's new catalog on precision machine tools, cutting tools, and other Ex-Cell-O precision products. Contains illustrations, descriptions, and specifications. A copy will be mailed free to any request on business letterhead. Ask for Ex-Cell-O Catalog No. 27121.

"We finish grind these fine pitch threads from hardened solid blanks . . . on EX-CELL-O Thread Grinders!"

XLO

EX-CELL-O for PRECISION



Extreme Accuracy In Form and Lead...*With High Production*

At Right: One of nine styles of Ex-Cell-O Precision Thread Grinders—Style 33 Automatic.

Precision THREAD GRINDING, BORING AND LAPPING MACHINES • TOOL GRINDERS • HYDRAULIC POWER UNITS • GRINDING SPINDLES • BROACHES • CONTINENTAL CUTTING TOOLS • DRILL JIG BUSHINGS • DIESEL FUEL INJECTION EQUIPMENT PURE-PAK CONTAINER MACHINES • R. R. PINS AND BUSHINGS • PRECISION PARTS

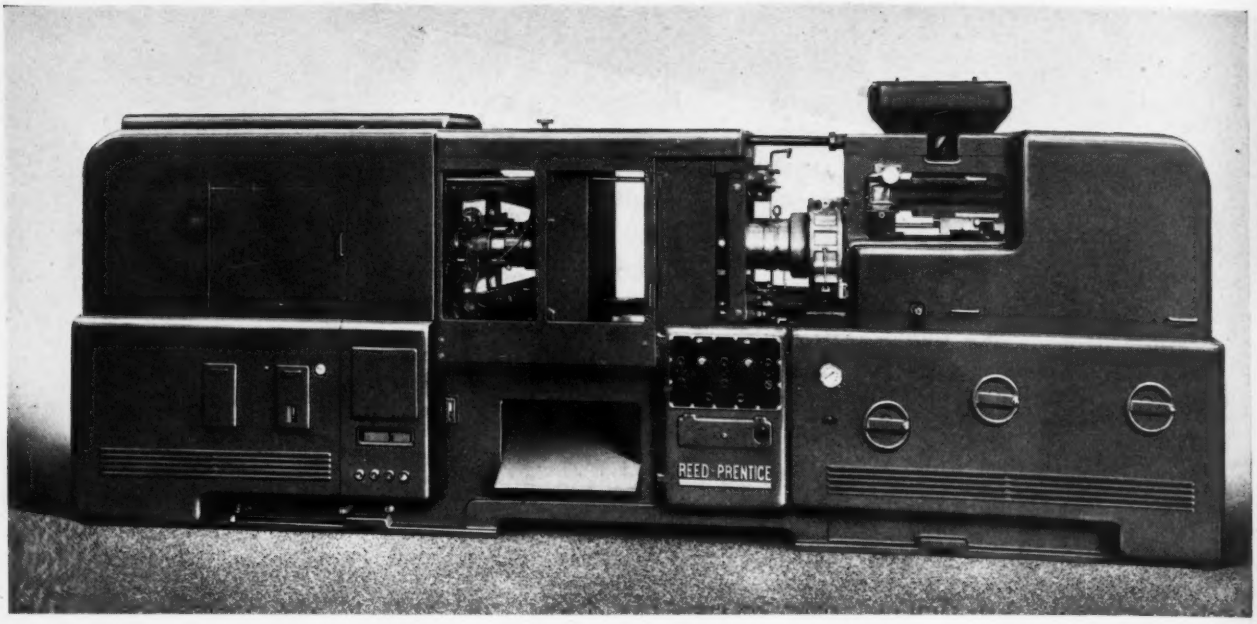


Fig. 2. Reed-Prentice Plastic Injection Molding Machine

The mold has a maximum casting area of 150 square inches. The machine is operated by a 40-H.P. motor having a speed of 1200 R.P.M. It is 210 inches long, 54 inches wide, and weighs 14 tons. 51

Double-End Chisel Grinding Machine

The Standard Electrical Tool Co., Department D-4, 2490 River Road, Cincinnati 4, Ohio, has brought out a heavy-duty double-end grinder for grinding chisels uniformly on a production basis. This new machine is of the self-contained belted motor-driven type. The patented chisel grinder attachment permits the production grinding of a wide variety of chisels. With this attachment, it is possible for one man to grind up to 1000 chisels per day. The attachment is intended not only for grinding new chisel blanks, but also for redressing used chisels.

High-speed resinoid bond wheels, 20 inches in diameter by 2 1/2-inch face, are mounted on the spindle, which operates at a speed of 1700 R.P.M. The machine is equipped with flanges for mounting wheels having 8-inch holes. The hoods or guards are designed to facilitate quick renewal of the grinding wheels. Each guard is furnished with all necessary fittings and an adjustable nozzle with valve for controlling the flow of coolant. The tank mounted on the back of the machine and fitted with a motor-driven pump supplies coolant at the rate of 10 gallons per minute.

At the left in the illustration the chisel is shown secured in a quick-acting holder, which permits unskilled operators to easily obtain a uniform finish on the chisel blanks. After the heel has been ground, the attachment is swung 90 degrees to a position similar to that shown at the right. 52

Chisel Grinding Machine Brought out by the Standard Electrical Tool Co.

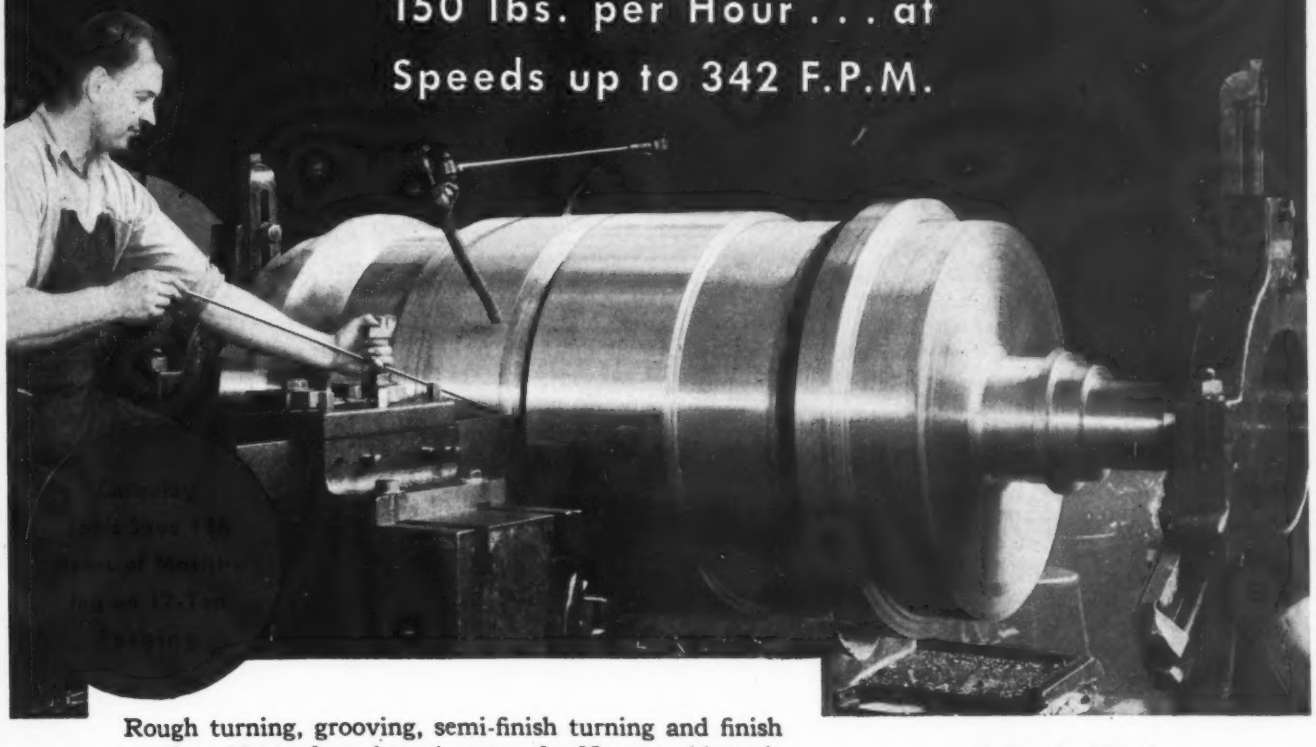
Abrasive Cone Adapter for Removing Burrs

The Behr-Manning Corporation, Division of Norton Co., Troy, N. Y., has brought out an abrasive "Metalite" cone and an adapter for holding it, which can be gripped in the chuck of a polishing lathe or in a chuck mounted on the spindle of an electric motor. The cone has an included angle of 45 degrees, and is designed to remove burrs from holes ranging from 2 to 7

To obtain additional information on equipment described on this page, see lower part of page 196.

Removing 6 TONS of STEEL...

150 lbs. per Hour . . . at Speeds up to 342 F.P.M.



Rough turning, grooving, semi-finish turning and finish spacing, 12-ton forged steel rotors, for Navy turbines, is a job that's "tough" on tools. To complete these operations, six tons of steel are removed, with tools taking cuts often as deep as ¾". Indicative of the ability of Carboloy tools to step up steel cutting production on heavy work such as this is the performance of Carboloy Grade 78-B on this application. Operating at various speeds ranging up to 342 F.P.M., and feeds from .010" to .047" Carboloy tools remove 150 lbs. of steel per hour, completing the job in 3⅓ days of actual machining time instead of the 11 days 4 hours formerly required.

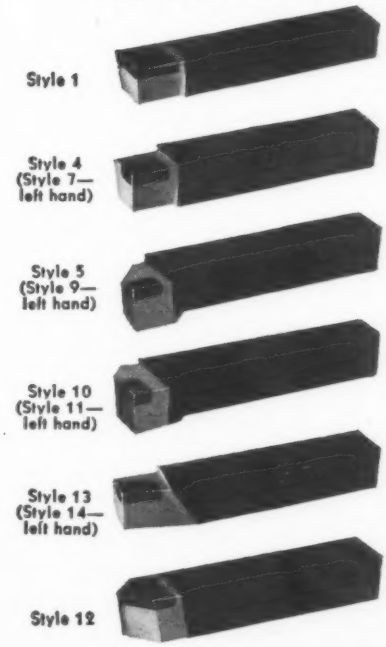
Carboloy tools—with hardness ranging up to 92.5 Rockwell "A" and transverse rupture strength up to 295,000 p.s.i.—are designed for the entire range of steel cutting. There is a grade for every application on steel, whether your job involves heavy duty work—such as these rotors, or high-speed, precision finishing, holding tolerances as close as 0.0002".

CARBOLOY COMPANY, Inc., Detroit, Michigan
11147 E. 8 MILE STREET

Birmingham, Alabama • Chicago • Cleveland • Los Angeles
Newark • Philadelphia • Pittsburgh • Seattle • Thomaston, Connecticut
Authorized Distributors: Canadian General Electric Co., Ltd., Toronto, Canada.
Foreign Distributor: International General Electric Co., Schenectady, N.Y.

Send for New, 16-page Vestpocket Manual on Steel Cutting with Carbides

10 Standard Stock Styles for Steel Cutting



For Cutting CAST IRON

CARBOLOY

(TRADEMARK) CEMENTED CARBIDES

For Cutting STEEL

FOR HEAVY HOGGING • • • PRECISION FINISHING • • • INTERMITTENT CUTTING

inches in diameter. It is especially adapted for removing the burrs and rounding the edges of holes cut or stamped in Dural metal stringers of aircraft for lightening the members. 53

Anderson Hydraulic Straightening Press

A sensitive, high-speed, hydraulic straightening press is now being manufactured by the Anderson Bros. Mfg. Co., 1907 Kishwaukee St., Rockford, Ill., to supplement its line of hand presses. Although the capacity of the new machine is 10 tons, it is claimed to be so sensitive that it can be used to bend a shaft as little as 0.001 inch.

A pressure gage indicates the ram loading; and beneath the ram, at the point of maximum deflection of the work, is located an adjustable dial indicator which clearly shows the amount of shaft run-out in the preloaded, fully loaded, and unloaded positions. Thus the exact load required to correct shaft run-out can be readily applied.

Use of the Barnes hydraulic system on this press provides four distinct advantages: (1) A flexible, sensitive control of the press is made possible by means of a unique rotary control valve operated from the front of the machine by a control lever. (2) Safe operation is assured by the spring return mechanism of the control lever. Release of the lever not only reduces the load immediately, but also causes the ram to return rapidly. (3) A high rate of production is attainable because of the rapid ram return speed. (4) Ease of operation is assured, since the operator has complete control of the press by simply depressing the lever until the desired load is attained and then releasing it to complete the cycle.

The length of the work-table is 60 inches. Available table attachments include checking rolls, spring-loaded centers, and adjustable anvils. An adjustable stop-collar is provided to limit the 6-inch maximum stroke of the ram. Hand-operated control equipment is standard, but provision can be made for foot operation. 54

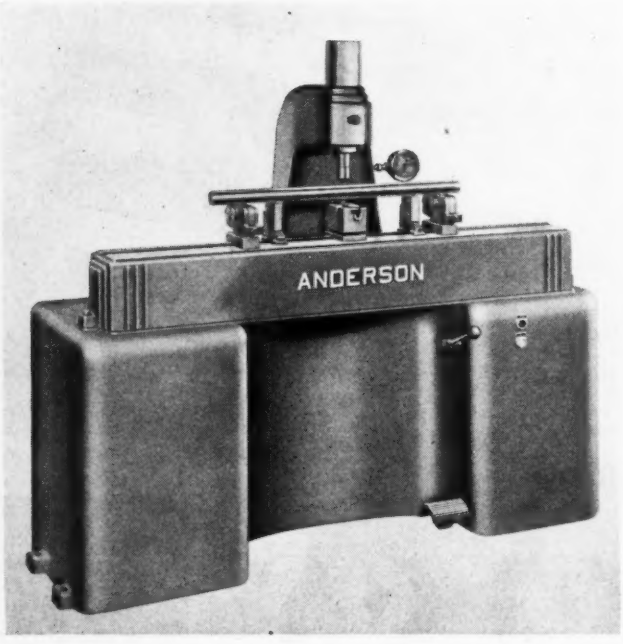
Heavy-Duty Hydraulic Metal-Cutting Machine

The Racine Tool & Machine Co., Racine, Wis., has just announced a new 20- by 20-inch capacity metal-cutting machine known as Model 36C. This machine was designed primarily to secure low cutting costs with a thin cutting blade when handling large pieces. It is particularly adapted for cutting die-block steel and other costly materials. The comparatively light-weight cutting blade used removes only a small amount of metal in the form of chips; thus where multiple cuts are made, a substantial saving results from this feature alone.

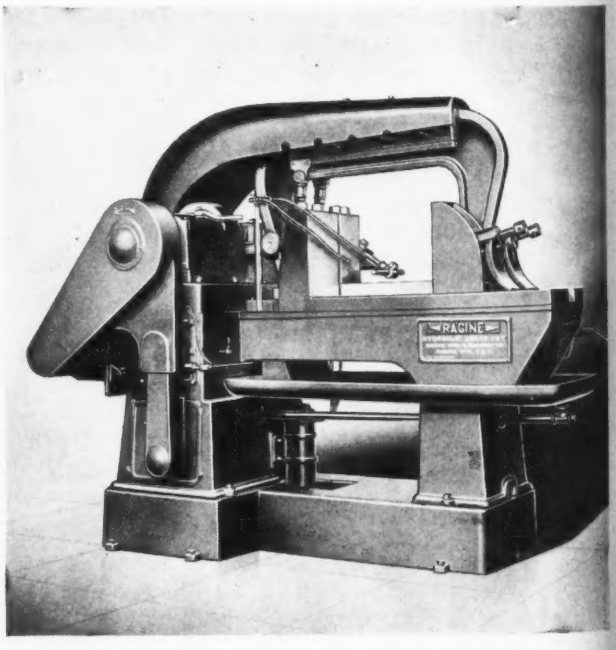
The machine is hydraulically operated, full control being accomplished by a single lever. A special dual type feed is used, which possesses rather novel advantages. It provides a fast cutting speed on light materials, and yet is arranged for a positive predetermined rate of cutting on die steel, alloys, and tool steel. A three-speed transmission provides cutting speeds of 65 to 85 and 115 strokes per minute. A 3-H.P. motor drive through V-belts is connected to the three-speed transmission by a "Twin Disc" clutch. 55

Plastic-Face Hammers and Plastic Mallets

Plastic faces are now available for the Basa replaceable-face hammers made by Greene, Tweed & Co., 4377 Bronx Boulevard, New York 66, N. Y. The company's Empire mallets are now also made both from a plastic material and from rawhide. The plastic selected has qualities making it specially



Anderson Sensitive High-speed Straightening Press



Racine Heavy-duty Metal-cutting Machine

To obtain additional information on equipment described on this page, see lower part of page 196.

Sidney Lathe PRECISION

meets the close tolerances of airplane manufacture

Easy to hold to infinitely close tolerances—rigid from the base up—smooth flowing power—sum up briefly the inherent qualities of Sidney lathes that adapt them to precision operations demanded in airplane construction.

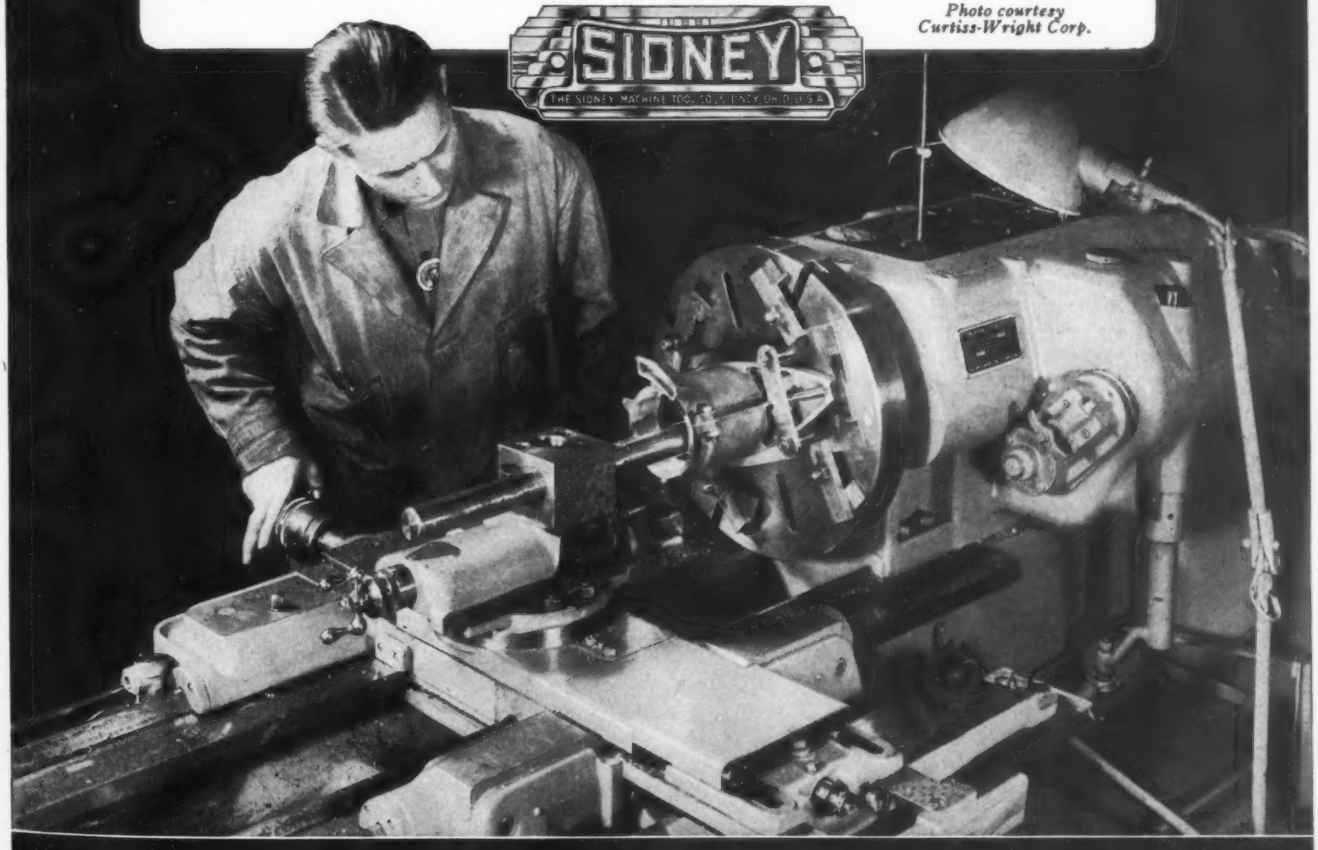
This illustrates but one of the Airplane Manufacturers who are now using not just one machine but batteries of Sidney Lathes on a host of widely different operations.

Your job may not be identical to this but if it calls for sustained accuracy over long periods it may best be done on a Sidney Lathe.

Built in 14" to 36" capacities to cover a wide range of manufacturing applications.

Bulletins available for each model.

Photo courtesy Curtiss-Wright Corp.



The SIDNEY MACHINE TOOL Company

Builders of Precision Machinery

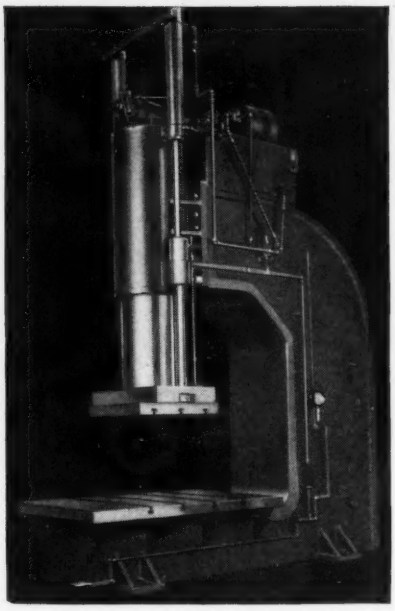
SIDNEY ESTABLISHED 1904 OHIO

adapted for the purpose of hammering, is tough and resilient, and will not chip, split, or mushroom, nor will it mar the struck surface. The plastic faces and the plastic mallets are recommended as a substitute for rawhide, which is now difficult to obtain. The dimensions and weights of the plastic faces and mallets are the same as of those made from rawhide. 56

General Electric Electronic Tube Flaw Detector

A new, high-frequency, electronic flaw detector for the production-line detection of longitudinal cracks and seams in non-magnetic metallic tubing in an extensive range of diameters and wall thicknesses has been developed by the Special Products Division of the General Electric Co., Schenectady, N. Y. This instrument is capable of detecting and locating imperfections 1/2 inch long, 10 mils wide, and one-third of the wall thickness in depth, even though they are on the inside of the tubing and do not appear on either surface.

The detector consists of a control unit, which is standard for testing various sizes of non-magnetic tubing, and a coil box that accommodates any one specific size of round, straight tubing of uniform outside diameter within the range of from 1/4 inch to 2 inches. Additional coil boxes are available for any size tubing within the dimensions specified. The power supply required for the electronic unit is 100 to 125 volts, 60 cycles. 57



Self-contained Hydraulic Press

Beatty 350-Ton Joggling Press

A new self-contained hydraulic press for joggling plates and shapes, heavy forming and bending operations in shipyards, car and tank shops, and for bridge and structural work has been brought out by the Beatty Machine & Mfg. Co., Hammond, Ind. This press has a stroke of 36 inches, an advance speed of 130 inches per minute, a pressing speed of 12 inches per minute, and a return speed of 175 inches per minute.

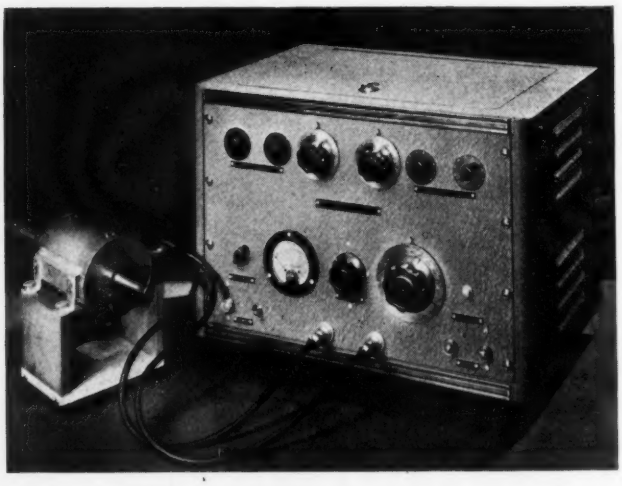
The maximum operating pressure of this press is 2000 pounds per square inch. The maximum opening is 69 inches, and the minimum die space is 33 inches. The table is 54 by 84 inches; the top platen, 36 by 36 inches; and the gap, 54 inches. The machine is arranged for either hand or foot control of the ram movement, and is built in capacities of from 5 to 350 tons. 58

Precision Universal Measuring Apparatus

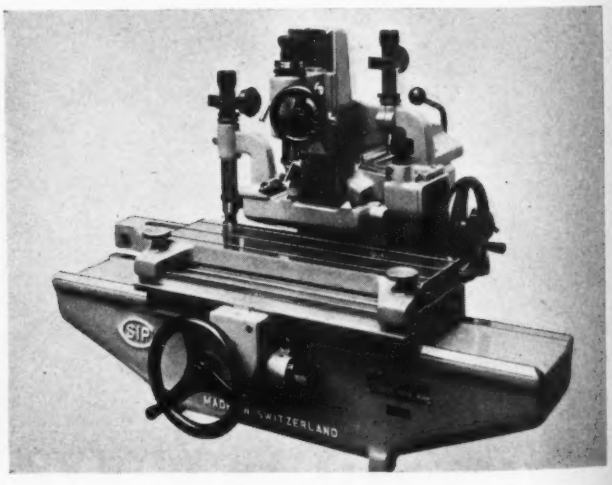
A universal precision measuring apparatus or instrument, designated the MU-214B, which offers an exceptionally wide range of application has been brought out by the Societe Genevoise d' Instruments de Physique, Geneva, Switzerland, and is being introduced in this country and Canada by the Cosa Corporation, 5000-4 Chrysler Bldg., New York City. This instrument can be used for all kinds of measurements of components ranging from the size of a tiny clock wheel up to the usual machine part.

The three microscopes with which this instrument is equipped have a measuring accuracy for rectangular coordinates of 0.0001 inch. The micrometer drums are divided into one hundred parts, each graduation being equal to 0.00005 inch. The standard scales are made of a special steel alloy and require no corrections for temperature changes. The microscopic lines used in measuring are ruled on a specular polished surface to an accuracy of 0.000005 inch.

The wide range of attachments available for use on this instrument

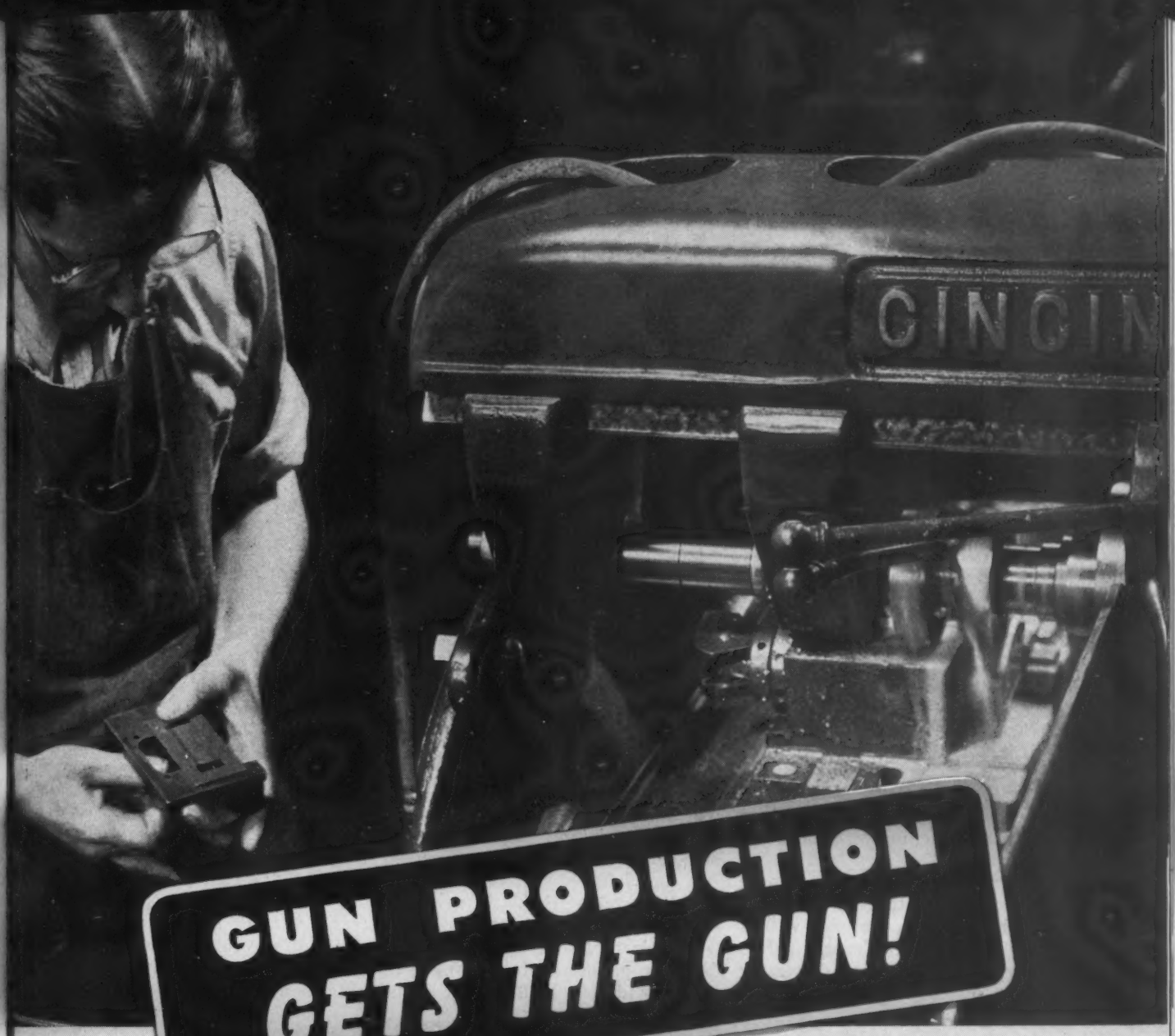


G.E. Electronic Equipment for Detecting Flaws in Tubes



Swiss Precision Universal Measuring Instrument

To obtain additional information on equipment described on this page, see lower part of page 196.



GUN PRODUCTION GETS THE GUN!

SUNOCO EMULSIFYING CUTTING OIL

increases cutter life . . . improves finish . . . cuts costs

The accuracy and speed with which American manufacturers are turning out vital parts for automatic guns for our armed forces is a production marvel . . . and Sun Oil Engineers and Sunoco Emulsifying Cutting Oil have a part in it!

One large plant, recently awarded the Army-Navy "E" for outstanding achievement in the production of automatic guns, had been having trouble on an important milling operation. Production was not up to rated capacity and the entire schedule was threatened by this bottleneck.

On the recommendation of a Sun Cutting Oil Engineer — a Doctor of Industry — they changed from the competitive product they were using to Sunoco Emulsifying Cutting Oil. Sunoco solved their problem! It was stable in emulsion . . . increased cutter life . . . produced a better finish . . . and in addition there was a saving of 25% in cutting oil costs and operators' complaints about skin irritation ended.

In this way — in hundreds of other ways — Sun Doctors of Industry and Sun Cutting Oils are contributing to the production miracle that is winning the war. Let them help you in your plant . . . write . . .

SUN OIL COMPANY • ***Philadelphia 3***

Sun Oil Company, Limited, Toronto, Canada

SUNOCO

SUN INDUSTRIAL PRODUCTS *HELPING INDUSTRY HELP AMERICA*

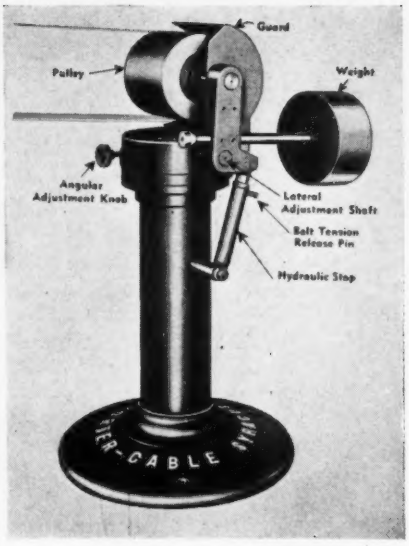
include a Goniometric microscope for measuring angles to one minute; tool-holders and various types of work-tables; center supports; special illuminating equipment; locating and spotting tools; precision rotary table; photomicrographic camera; dividing head; universal measuring table; and thread pitch measuring attachments. 59

Industrial Fluid Cooler

A refrigerating system for cooling industrial fluids, designated Model 400, has just been developed by the Gray-Mills Co., 1208 W. Ontario St., Chicago 10, Ill. This cooler is particularly adapted for mechanically refrigerating coolants or cutting fluids and settling and screening out chips and the coarser abrasives. Coolant is applied to the work by a self-contained pump.

The cooler is equally well adapted for cooling many industrial fluids and maintaining them at required temperatures. Examples of such applications are the cooling of oil or fluid employed in hydraulically operated presses or mechanisms, and the cooling and temperature control of quenching oils and bearing lubricants.

The cooler occupies a floor space of 28 1/2 by 33 inches, and is 44 inches high. It is equipped with a 1-H.P. compressor. Centrifugal or gear type coolant pumps driven by 1/2-H.P. motors are available.....60



Porter-Cable Back-stand Idler for Abrasive Belts

Porter-Cable Back-Stand Idler

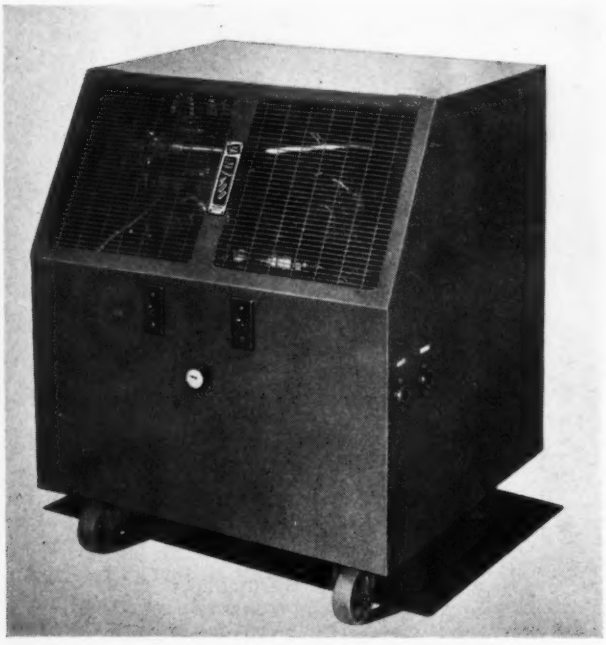
A new Model ABS back-stand idler has been brought out by the Porter-Cable Machine Co., 1801-12 N. Salina St., Syracuse 8, N. Y., which is designed to adapt grinding and polishing lathes to abrasive-belt grinding. This equipment is especially recommended for grinding welds and flash, generating radii, grinding flat and edge work, cleaning up, polishing, etc., using an endless metal-cutting belt of any width up to 6 inches. This type of abrasive belt is used to obtain faster cutting and to secure the desired finishes more easily. Heating of the work is greatly reduced by using the long abrasive belt, which lessens the danger of heat discoloration, warping, and fracturing.

It is claimed that the same results as are obtained by grinding, rough-polishing, and finishing on regular wheels can be secured by the abrasive-belt method without the rough-polishing operation.....61

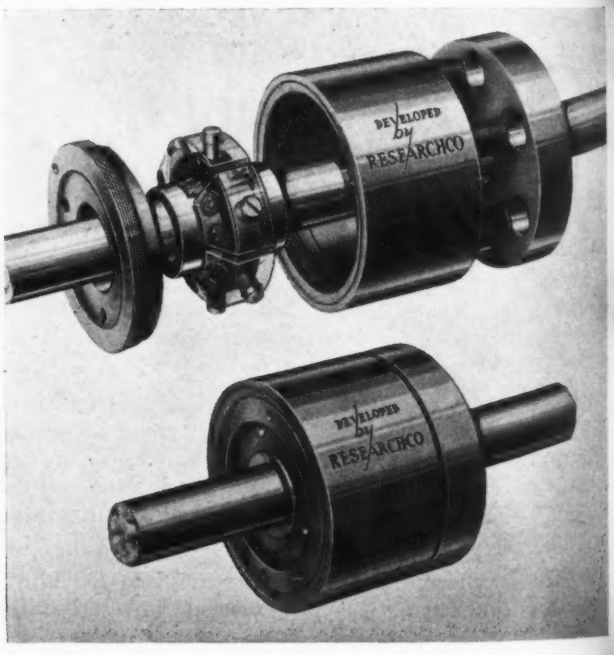
"Researchco" Universal Centrifugal Clutch

The Amalgamated Engineering & Research Corporation, 100 W. Monroe St., Chicago 3, Ill., known in the trade as "Researchco," has brought out a new type of automatically engaging and disengaging centrifugal clutch designated "Torkontrol." This new clutch, which is obtainable in any desired size and capacity, can serve either as a coupling between shafts or as a driving pulley or gear in a transmission, or a starting cushion between power units and driven mechanisms.

The clutch consists of a partially filled oil chamber fitted with a freely rotating hub which carries a series of movable wedge-shaped flyweights. As the hub revolves, these weights fly outward and engage the

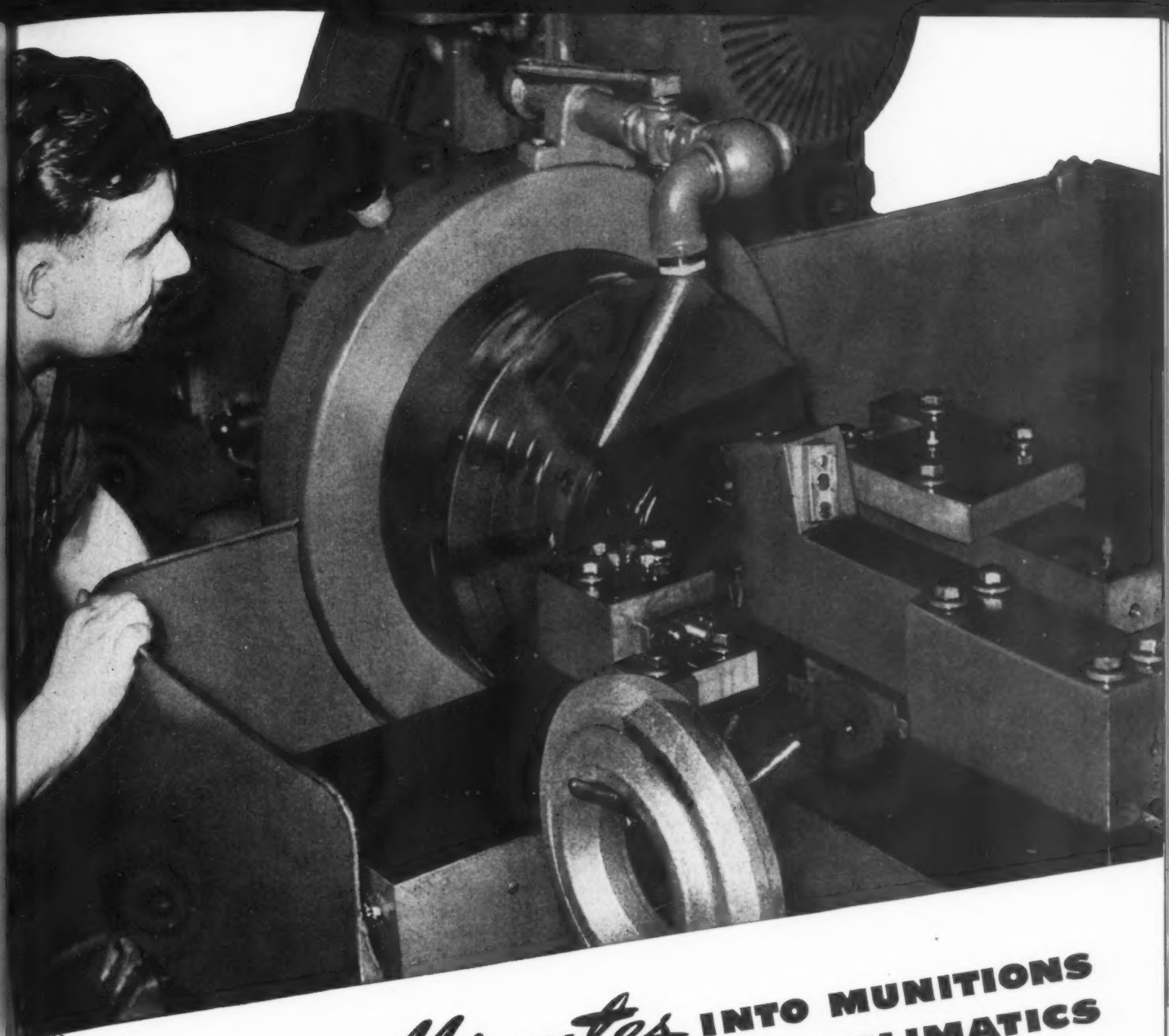


Gray-Mills Industrial Fluid Cooler



"Torkontrol" Universal Centrifugal Clutch

To obtain additional information on equipment described on this page, see lower part of page 196.



TURNING *Minutes* INTO MUNITIONS . . . . WITH SIMPLIMATICS

They're hard at it, these Simplimatics—giving added impetus to the unrelenting offensive in motion all the way between machine shops and enemies' lines.

Miracles in machining are made possible with the Simplimatics wherever large volume is required. Their automatic operation, speed and accuracy eliminate the need for highly skilled hands.

GISHOLT MACHINE COMPANY
1209 East Washington Avenue, Madison, Wisconsin

GISHOLT

LOOK AHEAD . . . KEEP AHEAD . . . WITH GISHOLT IMPROVEMENTS IN METAL TURNING

TURRET LATHES · AUTOMATIC LATHES · BALANCING MACHINES

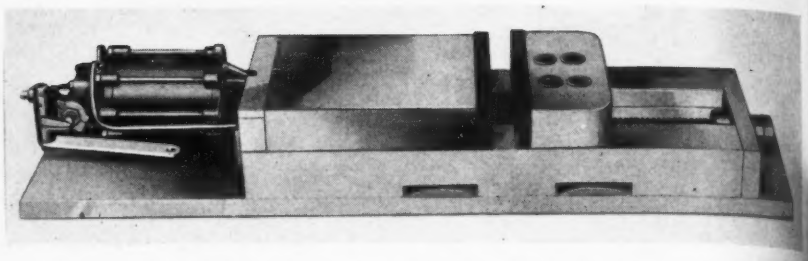
At Gisholt, the Army-Navy "E" and the Treasury Flag fly side by side

internal rims of the outer case, binding the hub and shell into a functionally solid pulley or coupling. This unit is reversible, since it works equally well in either direction. It is "set" to engage or release at a given speed and to slip in case of overload. It is claimed that this unit permits the use of smaller engines or motors, giving a smooth cushioned application of power with a straight-line acceleration that results in a saving in operating cost. Clutches of this line have been built in sizes ranging from 1/4 H.P. to 500 H.P. for both built-in and general applications. 62

DeWalt Portable Radial Saw

DeWalt Products Corporation, 1000 Fountain Ave., Lancaster, Pa., has just added to its line of radial cutting machines a new portable model which can be easily carried by two men to any point in the plant. It will cut ferrous and nonferrous metals when equipped with a metal saw or abrasive wheel, and can be used for cutting off wood material 14 inches wide by 1 inch thick or 12 inches wide by 3 inches thick with a 12-inch saw. It can also be used for ripping, beveling, mitering, shaping, and other woodworking operations.

This machine is available in 1 1/2, 2, and 3 H.P. sizes. The direct-drive motor is the protected type, Formex Fiberglas insulated, and provided with sealed ball bearings that require no lubrication. 63



Bellows Air-operated Milling Machine Vise

Automatic Air-Operated Milling Machine Vise

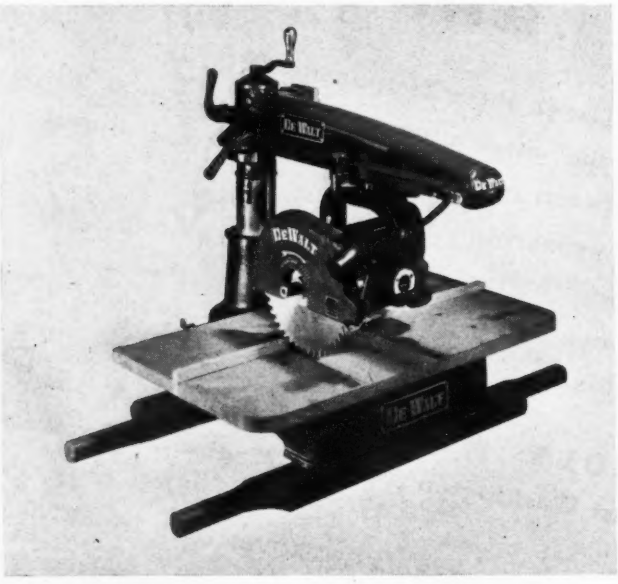
An automatic milling machine vise which develops clamping pressures that are adjustable up to 40,000 pounds, is a new product of the Bellows Co., Akron, Ohio. This vise (the CVH-60) receives power from a Bellows air motor operating on a line pressure of 80 to 100 pounds. Any desired pressure within the range specified can be applied and uniformly maintained. The air consumption is low, averaging less than 1/10 of a cubic foot of free air per cycle.

A double-acting valve integral with the vise has an adjustable control lever which permits operation of the valve from any angle in any plane. The control lever can be synchronized with a moving part of the machine to provide fully automatic operation. All enclosed parts are automatically lubricated by an oil mist from the air motor exhaust. The device is 27 3/4 inches long by 6 inches wide by 4 7/8 inches high, and has a maximum jaw opening of 5 3/8 inches. 64

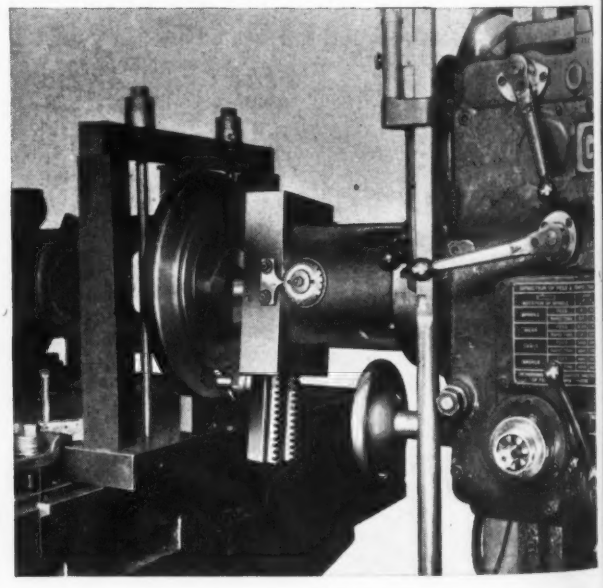
"Regent" Facing and Boring Head

The Paper Converting Machine Co., Green Bay, Wis., has developed a facing and boring head with a selective automatic feed that is being placed on the market under the trade name "Regent." This boring head is available in two sizes—the Model 20 with a range for handling work from 0 to 24 inches in diameter, and the Model 10 with a range from 0 to 12 inches in diameter. The Model 20 is shown in the illustration performing a step-facing operation.

The Regent boring head utilizes the forward and backward feed mechanism of the boring-bar itself

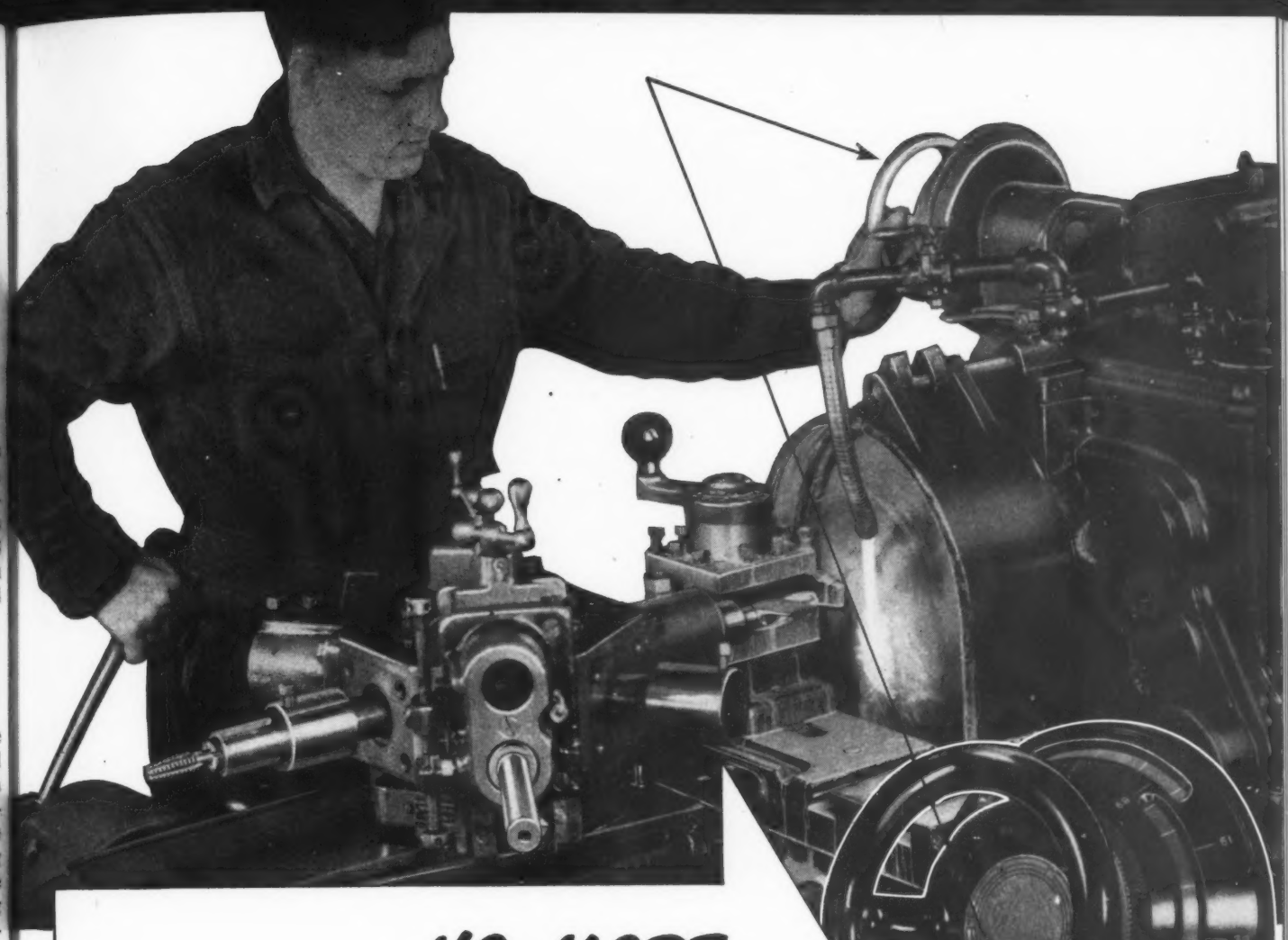


Portable Radial Cutting Machine Made by DeWalt Products Corporation



"Regent" Facing and Boring Head with Selective Automatic Feed

To obtain additional information on equipment described on this page, see lower part of page 196.



. . . NO MORE MANUAL GEAR-SHIFTING!

POWER-OPERATED SPEED SELECTOR PROVIDES AUTOMATIC SPEED CHANGING

Here's the lively change of pace that simplifies machining operations—speeds up turret lathe production.

You simply set the dial. The Gisholt Speed Selector responds with any one of twelve spindle speeds—makes the shift automatically by hydraulic power. Selecting the proper cutting speed is quick and easy for each operation in turning, drilling, boring, reaming, threading, etc. No time-wasting calculations; no complicated adjustments. The Speed Selector makes more expert operators—keeps machines producing at maximum efficiency with minimum effort.

Available for all standard Gisholt Turret Lathes, the Speed Selector is stepping up production in hundreds of vital war plants.

THE GISHOLT SPEED SELECTOR provides extreme flexibility to handle a wide variety of work. It may be used in two ways, as follows:

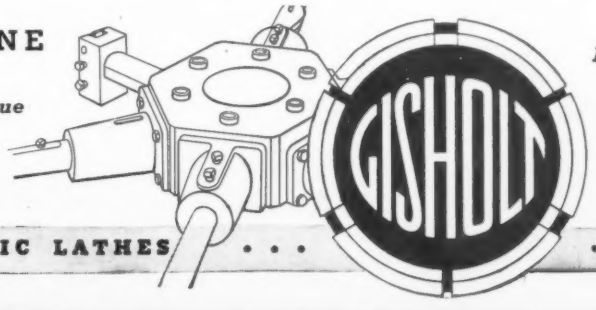
DIRECT—By simply turning the control wheel, the operator may obtain any desired spindle speed without intermediate stops.

PRE-SET—Speed is selected in advance of actual change. When operator finishes cut, he merely presses a trip; speed change is automatic.

In either case, when dial is set for any of the six high speeds, a touch to the trip produces a corresponding low speed for threading or reaming.

All spindle speed changes may be made without stopping the spindle or releasing the main drive clutch.

GISHOLT MACHINE COMPANY
1209 *East Washington Avenue*
Madison, Wisconsin



Look Ahead . . . Keep Ahead . . .
with Gisholt Improvements
in Metal Turning

URRET LATHES • AUTOMATIC LATHES . . . • BALANCING MACHINES

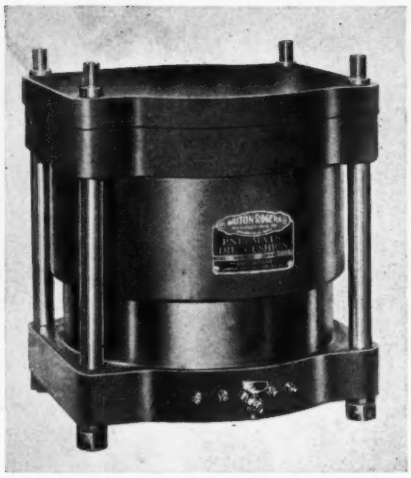
to automatically feed the tool-holder slide outward or inward, and thus provides a wide range of cuts for roughing and finishing. It is bolted to the spindle face of the boring-bar, and is so ruggedly made that it will take almost any cut the bar itself will stand. Micrometer feed adjustment is incorporated in the tool-holder for fine finishing cuts. ----------65

Dayton-Rogers Die Cushion

The Dayton Rogers Mfg. Co., 2835 S. 12th Ave., Minneapolis 7, Minn., has just brought out a new Model CB pneumatic die cushion that is completely self-contained and can be quickly and easily mounted directly on the bolster plate of practically any power punch press. This new design includes an all hardened and ground pin pressure pad that can be machined and fitted to the press bed openings of the individual presses used, thus increasing the pin pressure area to the maximum capacity of the press bed opening.

These pneumatic die cushions can be used to replace the springs and rubber on dies already in use. They are not limited to controlling the draw-ring on deep-drawing operations, but can also be used for controlling the pressure pad on a large percentage of forming dies.

The pneumatic die-cushion units are built in sizes of from 6 to 24 inches, have a drawing capacity from 2 to 12 inches, and will develop ring-holding pressures from 1 1/2 to 23 tons on an air-line pressure of 100 pounds per square inch. Each cushion is supplied with a combination reducing regulator, valve, and pressure gage, together with high-pressure hose fittings that facilitate quick and easy installation. ----------66



Pneumatic Die Cushion Made by Dayton Rogers Mfg. Co.

Tri-Bit Fly Cutters

Weddell Tools, Inc., 1239 University Ave., Rochester 7, N. Y., has recently developed a line of fly cutters made with one or more teeth consisting of Tri-Bit blades previously brought out by this concern. These blades are set at suitable rake and shear angles. The fly cutters thus produced are being widely used for high-speed milling operations, particularly for milling aluminum or magnesium and for the carbide milling of steel.

The Tri-Bit cutter blades can be ground for roughing or finishing, or one blade can be ground and set for roughing while the other is ground and set for finishing. The triangular tool bits are rigidly locked in position, being clamped into a V-shaped hole by a single locking screw. Another screw serves to back up the blade and affords a simple means of adjustment for size or wear. Tri-Bits are furnished in high-speed steel, cast alloy, or carbide-tipped materials.

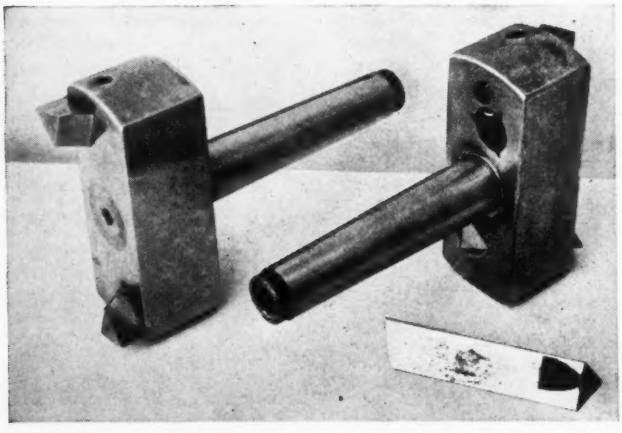
The cutter bodies are heat-treated alloy steel or Meehanite castings in sizes 2 1/2 inches in diameter and up, and are furnished either with a solid shank, as shown, or in the shell type to fit standard or special arbors. ----------67

"Speedaloy" Tipped Tools

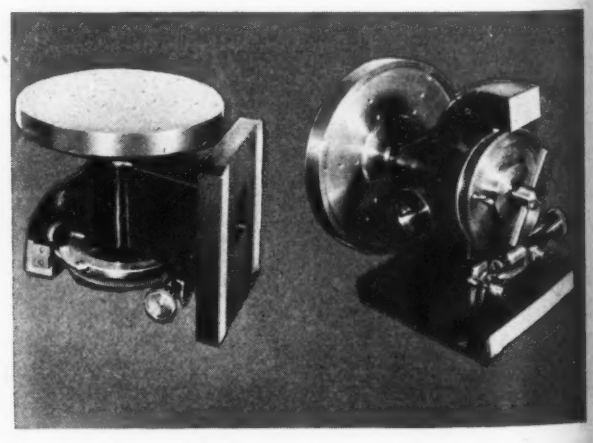
A new metal-cutting material for tipping tools, known as "Speedaloy," has been developed by the Tungsten Alloy Mfg. Co., Newark, N. J., to fill the gap between high-speed steels and tungsten carbide. Speedaloy is a cast tungsten-chromium-cobalt alloy that is claimed to stand up better than high-speed steel and to have higher shock resistance than tungsten carbide. The cost of these tools ranges between that of tungsten carbide and that of high-speed steel. ----------68

Studler Angle Computer

A new Studler angle computer is being manufactured by the Angle Computer Co., 5720 Melrose Ave., Los Angeles 38, Calif., for general shop use. This computer (known as Model C) is designed to insure accurate precision measurements of angles in vertical and horizontal planes. The protractor and vernier are calibrated to one minute, there

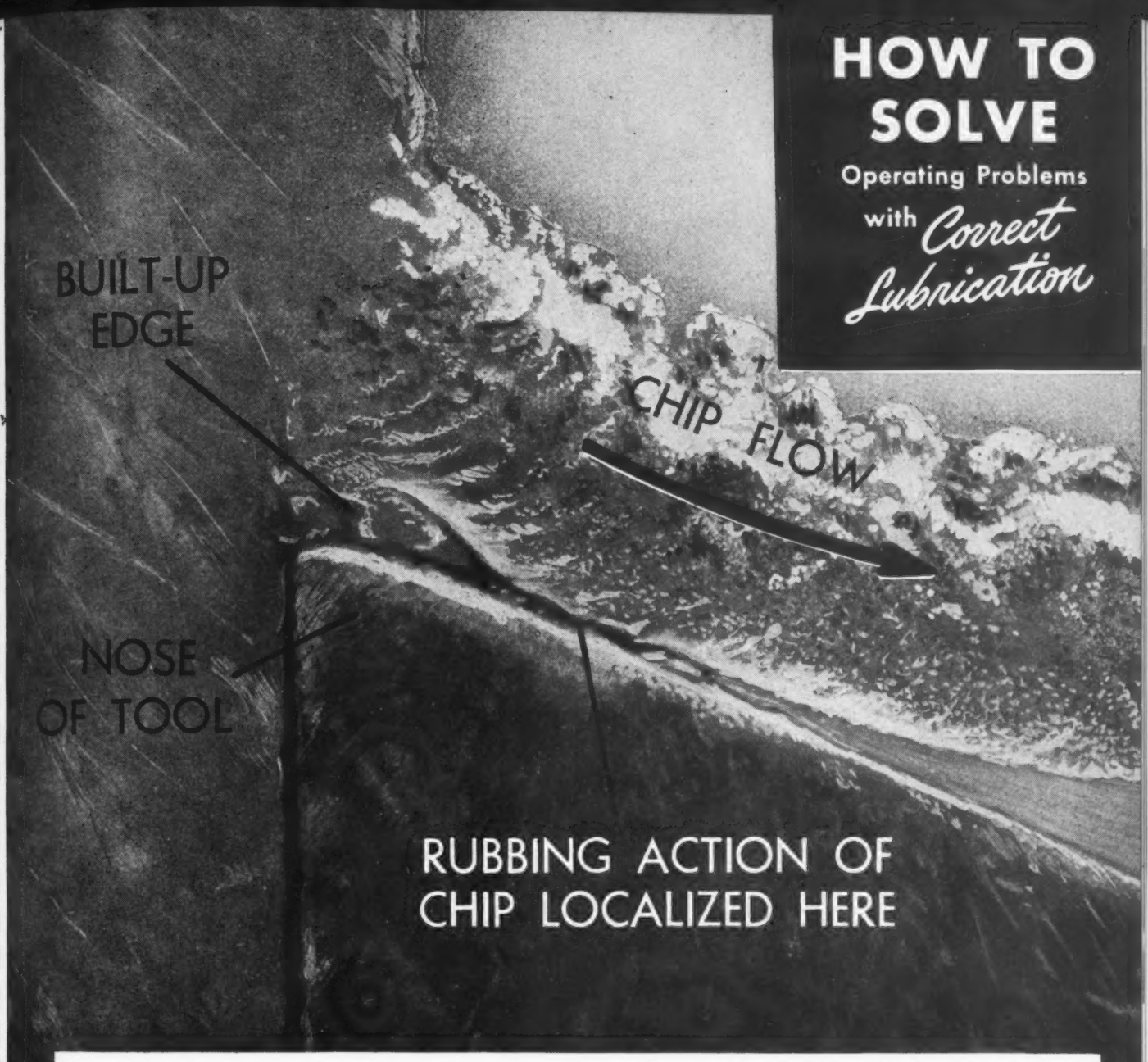


Tri-Bit Solid-shank Type Fly Cutters



Studler Angle Computer Shown in Two Positions

To obtain additional information on equipment described on this page, see lower part of page 198.



HOW TO SOLVE

Operating Problems with *Correct Lubrication*

Picture above courtesy Cincinnati Milling Machine Co.

New Facts on Metal Cutting

THE PICTURE ABOVE is a photographic enlargement of the cross-section of a tool cutting metal. NOTICE THE BUILT-UP EDGE. That small piece of metal alternately builds up and sloughs off. It is the key to tool life and work finish.

The built-up edge, during its existence on the cutting edge, exerts the pressure which does the actual cutting or shearing of the metal.

Sufficient build-up protects the cutting edge by localizing the rubbing action of the chip some distance from the cutting edge.

Excessive build-up is squeezed between the tool and the work and spoils the finish. *Adequate mobility* prevents this, and enables the built-up edge to slough off with the chip.

The "anti-weld" property of the cutting fluid controls the size and mobility of the built-up edge!

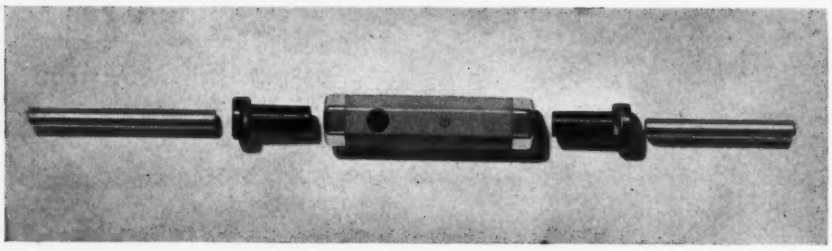
In the laboratory and in practice Socony-Vacuum technicians have isolated and studied many other factors necessary in a cutting fluid.

THIS IS NEW, IMPORTANT INFORMATION. It may be able to vitally improve your rate of production!

CARCOIL Lubricants

SOCONY-VACUUM OIL COMPANY, INC. — Standard Oil of N. Y. Div. • White Star Div. • Lubrite Div. • Chicago Div. White Eagle Div. • Wadhams Div. • Southeastern Div. (Baltimore) • Magnolia Petroleum Co. • General Petroleum Corp.

CALL IN SOCONY-VACUUM



"Plast-O-Lock" Collet Type Plug Gage Brought out by Turner Gauge Grinding Co.

being 21,600 precise spacings. The view to the left in the accompanying illustration shows the computer with the table in the horizontal position, while the view to the right shows it in the vertical position. 69

Sine Angle Wheel-Dresser

The Florian Mfg. Co., Plantsville, Conn., has developed a sine angle wheel-dresser to obtain speed and accuracy in angular form grinding. This new tool eliminates the need for costly special equipment or the alternative of time-consuming makeshift set-ups for dressing the wheels of surface grinders to the required angles.

By using this dresser with standard gage-blocks or adjustable parallels, wheels can be quickly dressed to any angle from 0 to 90 degrees with the assurance that the angles will be accurate within plus or minus 10 seconds. The setting is determined by the use of a simple formula. This precision dresser is ruggedly built and designed to withstand everyday shop use.....70

"Plast-O-Lock" Collet Type Plug Gage

A new collet type gage, known as "Plast-O-Lock," is being placed on the market by the Turner Gauge Grinding Co., 2625 Hilton Road, Ferndale, Mich. This new gage has as its outstanding feature a collet of plastic, slotted and tapered to fit into the tapered end of a standard gage-holder. Hand pressure on the collet is sufficient to lock the gage in the holder, and a partial turn of an end wrench unlocks it to reverse the gage or reset it at any desired protruding length. The collet is in one piece, so that a Plast-O-Lock double-end plug gage consists of only four separate parts —two plugs and two collets—in addition to the handle.

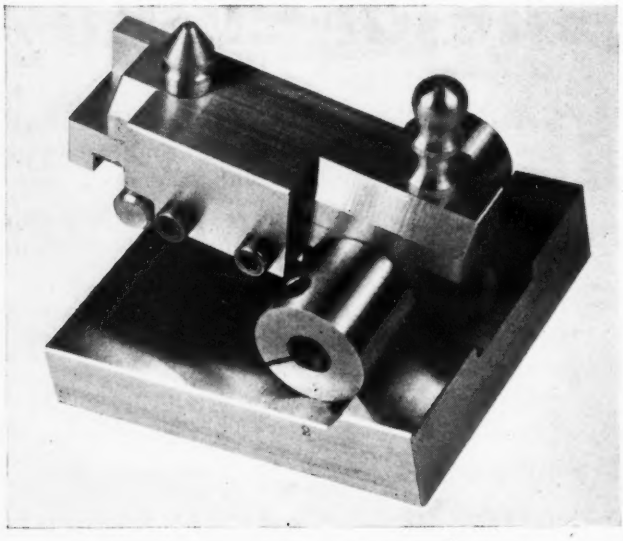
A plastic material was selected for the collet because it will not mar a lapped or polished surface. With the Plast-O-Lock feature, a large holding area of plastic against the metal surface of the gage prevents scratches or burrs and enables use of most of the gage's length for production purposes. The reversible feature alone provides double the life of a standard plug gage; and where shallow holes are being checked, the normal life will be several times greater, since the "Go" and "No Go" ends, when worn beyond allowed tolerances, may simply be cut off, thus leaving an unused section ready for gaging. If a bore no deeper than 1/8 inch is being checked, for example, as many as eight fresh sections can be obtained from one standard length of Plast-O-Lock "Go" gage. Early production is being limited to plug sizes ranging from 0.050 to 0.690 inch. 71

Micrometers Reading to Ten-Thousandths

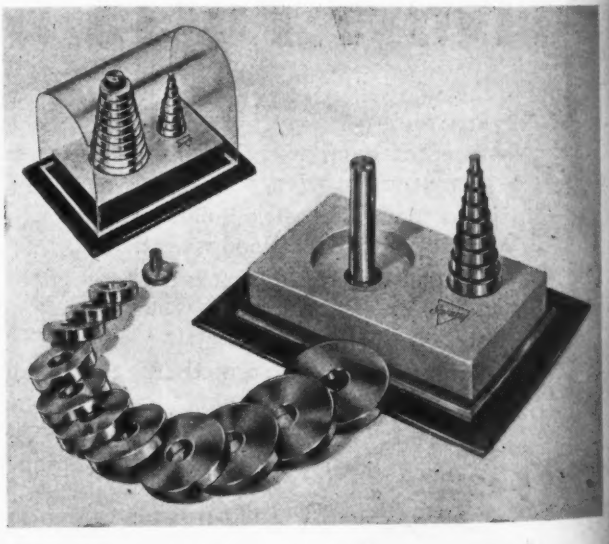
The George Scherr Co., Inc., 126 Lafayette St., New York 13, N. Y., has announced that all Reed micrometers in the 1-, 2-, and 3-inch sizes will be furnished to customers with a vernier which enables quick and easy readings to 0.0001 inch. There will be no extra charge for this new feature, which has been developed to meet the rapidly increasing demand for micrometers graduated for direct measurement of precision work. 72

Sav-Way Master Rolls for Checking Micrometers

Sav-Way Industries, Box 117, Harper Station, Detroit 13, Mich., have brought out a set of master setting and checking rolls for use



Wheel-dresser Made by Florian Mfg. Co.



Master Rolls for Checking Micrometers

To obtain additional information on equipment described on this page, see lower part of page 196.

GAZE ON A MIRACLE IN *Gear Production*

BOMBERS carrying bigger loads than freight cars! Fighters that can dive faster than sound travels! These are modern miracles of air warfare—miracles made possible by the giant Wasp Engines that power these planes.

And miracles beget miracles. For in these engines are gears of such extreme precision that their manufacture by any other method save exhausting hand labor, was long deemed impossible. Transforming these hand methods into mass production—turning out these high-precision gears by the hundreds of thousands needed for the world's largest air armada—was an achievement made possible by new manufacturing methods—new production techniques developed by Foote Bros.

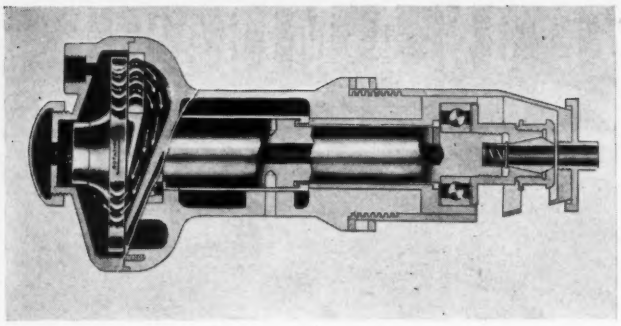
These precision gears may well open the way to new miracles in the economical transmission of power when the war is won. For already on the boards of many American manufacturers are plans for machines that will utilize the type of precision gear Foote Bros. are producing for aircraft engines.

FOOTE BROS. GEAR AND MACHINE CORPORATION
5225 South Western Boulevard • Chicago, Ill.

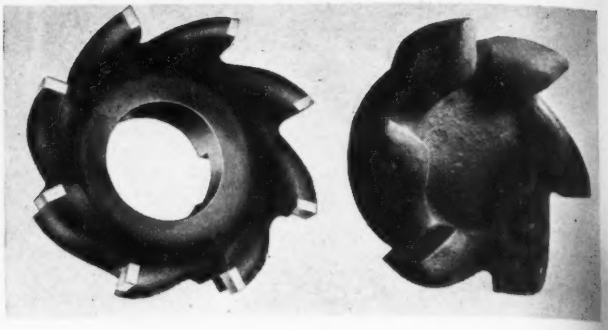
ARMY E NAVY

FOOTE BROS.

Better Power Transmission Through Better Gears



Onsrud Air-operated Turbine Motor with New Type Rotor



Meehanite Milling Cutter Bodies Made by Farrel-Birmingham Co.

in checking micrometers and other precision inspection and gaging instruments. The set consists of twenty rolls ranging from 0.1 inch to 2 inches in diameter. The rolls are hardened, ground, and lapped to gage-makers' X tolerance. They are deep-frozen before being finish-ground to eliminate internal strains and to provide accelerated aging.

This set of rolls was originally developed to meet the company's own need for a more accurate method of checking micrometers, snap gages, and other inspection devices used in connection with its production of precision aircraft, automotive, and ordnance parts. They are also useful in setting up work where dial indicators are to be used. ----73

Submerged Type Coolant Pump for Small Machines

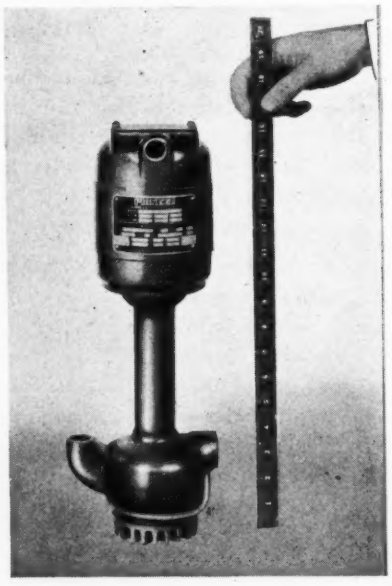
A small-sized seal-less pump, identified as Model MVA, which is designed for small machines, such as hand mills, surface grinders, internal grinders, drill presses, tapping machines, etc., has been added to the line of coolant pumps made by the Pioneer Pump & Mfg. Co., 19643 John R Street, Detroit 3, Mich. This small pump, just under 16 inches in height, has all the characteristics of the full-sized counterparts recently developed by the company.

It is intended for machines having a coolant sump in their base or for machines provided with separate coolant tanks. Brackets and flanges are available for mounting the pump on the edge, side, or top of the tank. Chips or dirt that will pass through the grille located in the bottom of the pump will readily pass through the pump without injuring it. ----74

Onsrud Air-Turbine Motors

The line of air-turbine motors built by the Onsrud Machine Works, Inc., 3940 Palmer St., Chicago 47, Ill., in a range of sizes from 1/6 to 3 H.P. with operating speeds from 15,000 to 100,000 R.P.M. now has a patented rotor of exceptional efficiency. This new solid milled rotor with bucket type impeller blades operates on an impulse reaction principle, employing an air feed-back system to achieve high efficiency. The expanding air, in combination with the patented Onsrud "Metered Mist" lubrication, serves to reduce wear.

Although developed for use on its own products, the company is now making its full line of air-turbine motors available for incorporation in the products of other manufacturers. ----75



Pioneer Coolant Pump for Small Machines

Meehanite Milling Cutter Bodies

To facilitate the application of the correct milling cutter to a particular piece of work, the Farrel-Birmingham Co., Inc., Ansonia, Conn., has developed milling cutter bodies of Meehanite which can be machined to receive carbide or cast-alloy tips within a broad range of rake and spiral angles.

A variety of body castings and cutting tips can be kept in stock by machine shops for use in making up cutters for a wide range of work. The user simply faces, bores, and slots the hub to suit requirements, mills the tooth seats, and attaches the desired tips by brazing. Carbide tips can be applied where a high-grade finish is required, and cast-alloy tips can be used for heavy roughing operations. ----76

McGill Vapor-Proof Safety Guard for Electric Light

A new vapor-proof safety guard for electric lamps that is entirely free from exposed metal and is shockproof and non-sparking has been brought out by the McGill Mfg. Co., Inc., Electrical Division, Valparaiso, Ind. This guard is designed to eliminate the danger of receiving shocks when handling electric lights in wet places—a hazard that has had fatal results in some instances.

The splashing of liquids cannot cause breakage of the light bulb, which is covered by a heat- and impact-resisting air-tight globe. The globe, in turn, is protected by a strong fiber cage which is treated to prevent warpage. The cage is firmly attached to an unbreakable plastic handle. The portable fea-

To obtain additional information on equipment described on this page, see lower part of page 196.

BOTTLENECKS
DAMN THE TORPEDOES
FULL SPEED AHEAD!

Making only Mounted Wheels and small Grinding Wheels—maintaining highest quality in spite of large quantities and rush orders—shipping them promptly. *This is our job, our battlefield.*

With full WPB approval, we stopped making all large size grinding wheels and fixed our sights on wheels *3″ in diameter and under.*

We worked all around the clock, 24 hours a day, and in a short time were able to fill orders on time—And, our central location cuts time in transit. Today, there is no waiting. With the Army-Navy E at our masthead, we are going full speed ahead.

AMERICA'S HEADQUARTERS FOR

MOUNTED WHEELS

Half a century of specialization has established our reputation as the Small Wheel People of the Abrasive Industry. You can bank on us.

TEST WHEEL FREE—To get acquainted with Chicago Wheels, let us send one postpaid. Tell us size wheel and material you wish to grind.

Write for illustrated catalog

ARMY E NAVY

CHICAGO WHEEL & MFG. CO.

1101 W. Monroe St., Dept. MR, Chicago 7, Illinois

MR-12.

Send Catalog. Interested in:

☐ Mounted Wheels ☐ Grinding Wheels ☐ Send Test Wheel. Size_____

Name _____

Address _____

ture enables the light to be taken wherever it is needed, and a fiber swivel hook permits it to be hung up at any convenient point. 77

Anker-Holth Foot-Operated Air Valve

A new foot-operated air valve designed for general use on all types of pneumatic equipment, such as air holding devices on lathes, air vises, operating cylinders, etc., is offered to the trade by the Anker-Holth Mfg. Co., 332 S. Michigan Ave., Chicago 4, Ill. It is made in sizes of from 1/4 to 1/2 inch, and is of the disk type. The pedal is easy to operate, and is returned to the neutral position by a spring. When the pedal is

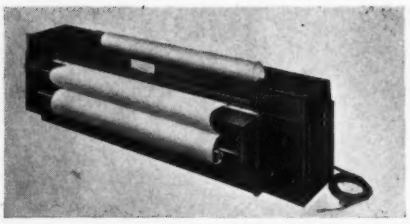
Foot-operated Air Valve Made by Anker-Holth Mfg. Co.

pushed down and the foot removed, it will automatically return to the neutral position, but the work will be held until the pedal is again pushed down. 78

Peck & Harvey Table Type Continuous Printers

Two table type continuous printers (B-1 and B-2) have been developed recently by Peck & Harvey, 4327 Addison St., Chicago, Ill. These two models produce clear, sharp blueprints or direct-process black and white prints up to 44 inches wide in any lengths at a speed up to 42 inches per minute. The cost is 1 to 1 1/2 cents per square foot, including labor.

The printers are compact, portable, and can be placed on any convenient table or bench. They are simple and easy to operate and maintain. No special wiring is re-



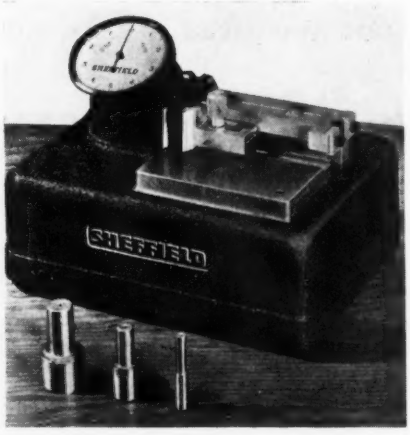
Peck & Harvey Continuous Black- and Blue-printing Machine

quired for this printer, connection being made with any standard electric outlet. 79

Sheffield Thread-Lead Checking Instrument

A new production type "Leadchek" is announced to the trade by the Sheffield Corporation, Dayton 1, Ohio. It is designed for the rapid and accurate checking of quantities of threaded parts, such as aircraft components, studs, and small shafts. It can be used to advantage in the receiving room or gage inspection department, where quantities of identical threaded parts require checking.

It is claimed that thread lead can be checked to an accuracy of 0.0001 inch more rapidly on this instrument than by any other method. The Leadchek will handle threaded lengths up to 2 inches, maximum. Threads as fine as 40 pitch or as coarse as 2 1/4 threads per inch can be checked. This instrument will check parts having diameters ranging from 0.125 inch to 2 inches, and can be obtained with a dial indicator, "Electrichek," or "Electrigage" head.

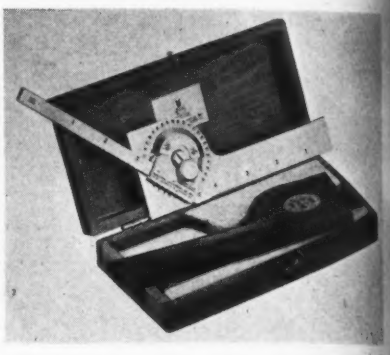


"Leadchek" Thread-lead Checking Instrument

The dial indicator has a range of 0.010 inch on the dial face and is graduated to 0.0001 inch. The gage is of simple rugged construction, and has sufficient capacity for a wide range of production thread checking. 80

Improved Lock Type Protractor

A pocket size, lock type protractor, known as the "Xactor," for use in the engineering field and for precision shop work, such as tool



Pocket Size Protractor Made by Industrial Engineering Co.

grinding, machining, and inspection, has been placed on the market by the Industrial Engineering Co., Inc., 141 W. Jackson Blvd., Chicago 4, Ill. This protractor is adapted for the accurate measuring of the angles on drill points, tool bits, machine ways, depths of holes, and for use in sketching and laying out tools and machine parts, dies, and jigs. The protractor is vernier-equipped, and has an adjustable lock type sliding scale which pivots the full 360 degrees for measuring any angle to an accuracy of one-half of one degree. Deeply etched graduations facilitate reading, even in poor light. 81

* * *

Two 20,000-H.P. electric motors for the Army's new stratosphere wind tunnel at Wright Field are being constructed by the Westinghouse Electric & Mfg. Co. Each of these motors is twice as powerful as the largest electric motors supplied to steel mills. The two driving units will produce a 600-mile-an-hour current of cold air to test high-altitude performance of aircraft.

To obtain additional information on equipment described on this page, see lower part of page 196.

GUARD Your Screw Driving Army Against Injury and Absence

PHILLIPS SCREWS ARE SKID-PROOF!

No hand-injuries from skidding screw drivers! That's the protection against absenteeism you can get by using Phillips Recessed Head Screws. The scientifically designed Phillips Recess automatically centers the driver in the screw head . . . utilizes full turning power . . . and "brakes" the driver against skidding!

Safe, faultless screw driving no longer means slow output. Old hands and new, alike, work faster and surer with Phillips Screws. There are no fumbling, wobbly starts . . . slant-driven screws . . . or burred and broken screw heads. Spiral and power driving are made practical. In literally thousands of plants, replacement of slotted-head screws by Phillips Screws has increased screw driving speed up to 50% . . . and has entirely eliminated rejections due to driver gouges.

Compare the costs of driving Phillips and slotted head screws. You'll find that it actually costs less to make fastenings with Phillips Recessed Head Screws!

PHILLIPS *Recessed Head* SCREWS

KEY TO FASTENING SPEED AND SAFETY

The Phillips Recessed Head was scientifically engineered to afford:

Fast Starting – Driver point automatically centers in the recess . . . fits snugly. Screw and driver "become one unit." Fumbling, wobbly starts are eliminated.

Faster Driving – Spiral and power driving are made practical. Driver won't slip out of recess to injure workers or spoil material. (Average time saving is 50%.)

Easier Driving – Turning power is fully utilized by automatic centering of driver in screw head. Workers maintain speed without tiring.

Better Fastenings – Screws are set-up uniformly tight, without burring or breaking heads. A stronger, neater job results.

WOOD SCREWS • MACHINE SCREWS • SELF-TAPPING SCREWS • STOVE BOLTS

21 SOURCES

American Screw Co., Providence, R. I.
The Bristol Co., Waterbury, Conn.
Central Screw Co., Chicago, Ill.
Chandler Products Corp., Cleveland, Ohio
Continental Screw Co., New Bedford, Mass.
The Corbin Screw Corp., New Britain, Conn.
The H. M. Harper Co., Chicago, Ill.
International Screw Co., Detroit, Mich.
The Lamson & Sessions Co., Cleveland, Ohio
The National Screw & Mfg. Co., Cleveland, Ohio
New England Screw Co., Keene, N. H.
The Charles Parker Co., Meriden, Conn.
Parker-Kalon Corp., New York, N. Y.
Pawtucket Screw Co., Pawtucket, R. I.
Pheoll Manufacturing Co., Chicago, Ill.
Reading Screw Co., Norristown, Pa.
Russell Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.
Scovill Manufacturing Co., Waterville, Conn.
Shakeproof Inc., Chicago, Ill.
The Southington Hardware Mfg. Co., Southington, Conn.
Whitney Screw Corp., Nashua, N. H.

Reducing the Frequency of Skin Infections in Metal-Working Plants

HARSH and harmful hand cleaning soaps and compounds used because they work fast, as well as because they are usually low in cost, are doing much to increase lost time due to skin infections in metal-working plants. This fact is called to the attention of industrial managers by Dr. R. W. Mitchell, technical director of the Magnus Chemical Co., Garwood, N. J.

About 70 per cent of industrial diseases are skin infections. Many of these are due to improper methods of cleaning the hands during and after work. Proper methods of cleaning the hands can reduce the time lost through skin troubles to a considerable extent.

First of all, a hand cleaner should not be strongly alkaline, although it must be so to a certain extent in order to clean off grease and oil; but if it is so strongly alkaline that the skin is robbed of its natural oils in the washing process, this leads to chapping or cracking, particularly in cold weather, which, in turn, invites infection. Heavy scrubbing and brushing are other sources of abrasions and irritation that invite infection.

A harsh, gritty scouring agent obviously will speed up the cleaning process, but it also scratches and abrades the skin, laying the hand open to infection to a degree that only an industrial physician can appreciate. There are, however, safe and effective scouring agents for hand cleaning in metal-working shops. Probably the best is a carefully graded, processed, and selected pumice, which, while having excellent scouring action, does not scratch or abrade the skin. Cornmeal is another widely used and effective hand scouring agent. A hand cleaner made up of a good soap with selected alkaline salts and pumice or cornmeal will do as fast a cleaning job as any sand soap without scrubbing or brushing, and will not scratch the skin and irritate cuts or abrasions. A well compounded hand cleaner will rinse off speedily and thoroughly even in cold water. The effects of soap residues left on the skin should not be overlooked, because they are a source of trouble.

Now, how can the danger of infections caused by harsh and scratchy sand soaps best be avoided? As long as the old-fashioned plan of expecting the worker to buy his own soap is followed, the introduction of safe cleaners is bound to be slow. Left to himself, the average worker will buy the cheapest soap that gets his hands clean the quickest. The answer to this problem is, therefore, for management to assume the responsibility of supplying its plant wash-rooms with a satisfactory hand cleaner. It should also see to it that only the selected safe cleaner is used. Many authorities on the subject prefer a powdered cleaner, not only because of the ease in dispensing it exactly in suitable amounts, but because of the hygienic method possible in dispensing. A simple device measures it in adequate quantities and supplies each worker with just enough to do a good cleaning job without waste.

Then, according to Dr. Mitchell, we come to the question, "Can any effective protection be offered for the hands while working?" This is possible through the use of one of the compounds now available, which provide the metal-worker's hands with a very thin but effective "glove" while on the job. These compounds are supplied in the form of a greaseless cream, which is rubbed into the skin of the hands before starting work. The skin is not greasy to the touch, but, nevertheless, there is a coating that will last for some time and that acts as an impervious layer between the skin and the materials, oils, greases, etc., handled. Furthermore, since dirt and grease is deposited on the surface of this "glove" rather than on the skin, the hands are very easily cleaned.

When the shortages of man labor brought more and more women into metal-working plants, it was thought at first that the skin of their hands, being presumably more tender than that of men, would lead to increases in skin infections. Experience indicates that women's hands toughen quite rapidly, so that skin troubles due to working conditions are not higher with women than with men, especially after a few weeks on the job. For that reason, the same kinds of hand cleaning materials and protective creams used by men are suitable for women.

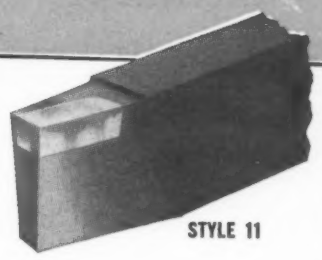
Elwell-Parker Electric Co.'s Fiftieth Anniversary

The Elwell-Parker Electric Co., Cleveland, Ohio, has just completed its fiftieth year in business. The firm of Elwell-Parker, Ltd., of Wolverhampton, England, builder of motors and generators, licensed the present Elwell-Parker Electric Co. in 1893 to build this equipment in America. For some time the entire output of the new plant went to the Brown Hoisting Machinery Co. for use in ore-handling equipment. Later, the company built motors for passenger and commercial vehicles; but for the last thirty years, the concern has given its attention exclusively to material-handling equipment—electric trucks for industrial uses.

Barnes Hacksaw Production Calculator

The W. O. Barnes Co., Inc., has recently issued a hacksaw production calculator designed to show the time necessary to make cuts with power hacksaws in steel of various specifications. SAE, AISI, and AMS steel specifications are listed on the table on the reverse of the calculator, and the machinability factor of these steels is included. With this factor known, the size and shape of the bar stock being cut are set up on the slide, and the time necessary to make the cut is read over the machinability factor. Copies can be obtained by writing on a business letter-head to W. O. Barnes Co., Inc., 1297 Terminal Ave., Detroit 14, Mich.

What do you expect of a Cutting Tool?



STYLE 11

KENNAMETAL WILL GIVE IT TO YOU *and More!*

STYLE 3

HALF SIDE MILL

STYLE 6

SPECIAL MILLS

Would you like to double cutting speeds so as to step up production? With KENNAMETAL, increases of 300 to 500% over high speed steel tools, and 50 to 100% over ordinary carbides are common.

Would you like to eliminate snagging and clean up operations now required before machining because of hard scale or flashing? KENNAMETAL tools will cut through sand pockets, hard spots, and tough scale.

Do you want to avoid the necessity for two cuts, roughing and finishing? With KENNAMETAL it is possible to take heavy cuts and still leave a clean, true surface.

Do you want to eliminate grinding operations? KENNAMETAL tools will machine to a smooth finish and accurate size from end to end even on long parts such as shafts and gun barrels.

Would you like to "gang up" several parts to save machining time, but hesitate because of the interrupted cuts involved? KENNAMETAL tools are sturdy and will take such jobs in stride.

Many plants are now taking advantage of these possibilities by using KENNAMETAL with its high hardness, extreme wear-resistance, and shock-resistance. You, too, can benefit by using the distinctive KENNAMETAL tools. There is a type and size for every carbide application, be it turning, facing, boring, or milling. Each tool produces consistently good performance throughout its scope of applicability.

These are listed and described in our latest Catalog 43C. Do you have your copy?

KENNAMETAL *Inc.*

147 LLOYD AVE., LATROBE, PA.

Trade Mark Reg. U. S. Pat. Off.

KENNAMETAL THE All American CARBIDE

MACHINERY'S Handbook Now in Its Twelfth Edition

Most readers of MACHINERY have become acquainted with the general characteristics of MACHINERY'S HANDBOOK through actual usage in connection with the design or manufacture of mechanical products; hence, in this review, we shall merely outline some of the more important revisions or additions found in the Twelfth Edition.

Incidentally, in the editing of MACHINERY'S HANDBOOK, we endeavor to keep pace with important current developments in the machine-building field by revising the HANDBOOK at frequent intervals. In order to accomplish this, the total number of books in each printing is established, as far as possible, so that a given issue can be distributed within a few months; consequently, frequent revisions are possible and handbook improvement is on a continuous basis.

The following summary includes additions that may be of interest to the average handbook user: Planetary gear designing charts containing clearly arranged diagrams showing twenty-four different planetary gear designs or problems with simplified formulas for finding the ratio and direction of driven gear rotation; miscellaneous additional formulas relating to strength of materials and other designing problems; Class 5 screw thread fit for threaded steel studs as approved for federal services by the Government, with table of stud and tapped-hole sizes in both coarse- and fine-thread series; standard grinding wheel markings adopted by the Grinding Wheel Manufacturers' Association to indicate abrasive grain size, hardness or grade, structure or density, and bonding process; permissible variations in sizes of cold-finished and hot-rolled bars; American standard thread gage and plain gage tolerances; manufacturers' standard gage for sheet steel (now used in place of the original U. S. standard gage); thickness tolerances adopted by sheet steel manufacturers for both hot-rolled and cold-rolled sheets; American standard pipe threads (1942 revision), including taper threads, straight threads for mechanical joints, and internal threads for couplings and lubrication fittings; American standard for gas cylinder outlet threads; American standard hose connections for welding or cutting torches; aeronautical screw thread series; tipping tools with high-speed steel and carbide tips; braze-hardening; revisions in S A E steels, including both old and revised composition numbers; general applications of S A E steels with 270 typical uses arranged in tabulated form and alphabetical order; standard speeds for motor reducers as adopted by National Electrical Manufacturers Association, and various other revisions and improvements.

The practical value of these additions or revisions naturally varies more or less with each handbook user, owing to the great diversity of problems encountered in the machine-building field. Perhaps, in the last analysis, the actual usage of a handbook is the most reliable index of its real value. In this connection, MACHINERY'S HANDBOOK, on the basis of both current and total sales, probably is the most widely used engineering work of reference in the United States and throughout the British Empire. Even the "Japs" have stolen it and published, surreptitiously, a translated edition. While this is unfortunate, it does prove that thieves may also be discriminating.

* * *

Using Fluorescent Light to Detect Flaws

Fluorescent tubular lights of three colors are being used in an interesting manner to aid inspection work in a windowless, air-conditioned room of a manufacturing plant. In this particular room, more than six hundred 40-watt fluorescent tubular lamps are in use. The white fluorescent lamps, which are run in a line along the room, are alternated at various points by green and blue tubes.

With this lighting arrangement, flaws and defects in work can be readily detected by tilting the work toward the blue or green light band. The defects are disclosed at the point where the reflection on the work meets the reflection from the normal or white lighting.

Recent Army-Navy "E" Production Awards

The latest names added to the list of firms in the metal-working and machine-building fields to receive the Army-Navy "E" Production Award or a renewal of the Award for six months of continued high production are as follows:

American Foundry Equipment Co., Mishawaka, Ind. (renewal).

Bullard Co., Bridgeport, Conn. (third award).

Cleveland Worm & Gear Co., and Farval Corporation, Cleveland, O.

Greenfield Tap & Die Corporation, Greenfield, Mass. (third award).

Lindberg Engineering Co., Chicago, Ill. (renewal).

McGraw Electric Co., Elgin, Ill.

Metal Mfg. Co., Long Island City, N. Y.

Ransome Machinery Co., Dunellen, N. J.

Schauer Machine Co., Cincinnati, Ohio (renewal).

Sundstrand Machine Tool Co., Rockford, Ill. (renewal).

Weatherhead Co., Cleveland, O. (renewal).

* * *

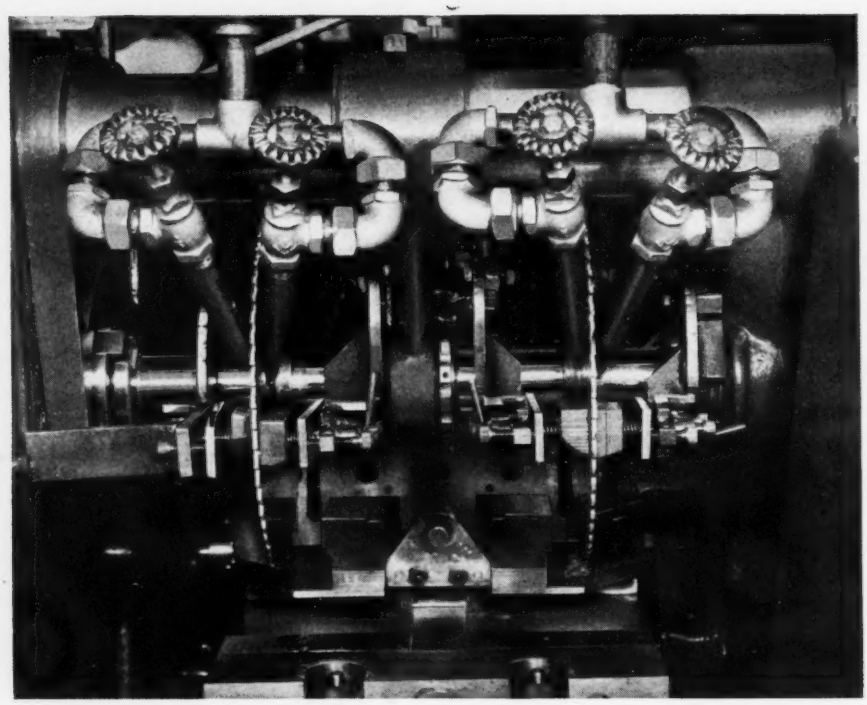
Film on Fabricating Magnesium Alloys

The Dow Chemical Co. has recently prepared and released a technical film describing processing methods for magnesium alloys. The film deals with the machining, welding, forming, riveting, and surface treating of magnesium, and is available for showing before engineering, industrial, and technical society groups. Requests for use of the film (or for information regarding it) should be directed to the Dow Chemical Co., Midland, Mich.

* * *

When I tell you that there is no man-power shortage as such, but merely a lack of the proper utilization of our present labor forces, I give you not only the result of my own observation in war plants, but also that of practically every industrial engineer who has studied the relationship of production and manpower closely.—*O. C. Cool, Director of the Labor Relations Institute, New York City*

LAKE ERIE
ENGINEERING CORP.
BUFFALO, N.Y. U.S.A.
Our Engineering, Research and Designing Departments are humming these days, exploring new and practical ideas for LAKE ERIE Hydraulic Presses to fabricate many promising post-victory products.



Use of Micarta Pressure Pads Prevents Tungsten-Carbide Saws Used on a Milling Machine from Chattering

Eliminating Tool Chatter Marks by Means of Pressure Pads

When heavy cuts are taken in hard material, metal-cutting tools are likely to chatter and leave distinct marks on the work, which are sometimes objectionable. This is particularly true in the case of large-diameter milling cutters. The accompanying illustration shows how the Sharon Works of the Westinghouse Electric & Mfg. Co. mounted pressure pads made of Micarta on the upper guide arms of a milling machine to eliminate chatter and thus insure smooth cuts. The Micarta blocks or pads are held in contact with the tungsten-carbide saws and serve very effectively to prevent the saws from vibrating, thus obviating chatter marks on the two faces of the cut.

Use of these pressure pads has resulted in increasing saw or cutter life about 30 per cent, and has also increased the number of cuts obtained per grind about 30 per cent. The quality of the work has also been improved considerably.

It is Time to Call a Halt

The Governor of Ohio, John Bricker, recently pointed out that the government of his state gets along with 25,000 employes, while the federal government in the state of Ohio has 90,000 employes. In Massachusetts, there are 21,000 state employes and 129,000 federal employes. In Pennsylvania, there are 44,500 state employes and 215,000 federal employes. In Wyoming, the state employs 1100 people, while there are 6200 on the federal government's payroll. With more than 3,000,000 civilian employes—exclusive of the Army and Navy—our federal government now has more persons on the taxpayers' payroll than the combined total of all the employes of all the forty-eight states plus all the employes of all the country's county and municipal governments—*Harry F. Byrd, United States Senator from Virginia, in the New York World-Telegram*

Silver Additions Improves Bronzes

The American Silver Producers' Research Project has published the following conclusions as to copper-tin-silver alloys: About 3 per cent of silver in wrought alloys of copper with 5 to 10 per cent of tin renders them susceptible to precipitation hardening. Such bronzes, when heat-treated, show marked increase in yield strength without significant decrease in ductility, electrical conductivity, or resistance to corrosion. Moderate cold-rolling produces physical properties superior to those obtained by heat-treating 10 per cent tin bronzes containing economically reasonable proportions of tin.

In cast alloys of copper with 10 per cent tin and 3 to 5 per cent silver, there is a mild response to precipitation hardening treatment, but the improvement does not justify the cost of the silver. Silver does produce grain refinement in cast bronzes, however, and restrains grain growth in wrought bronzes. The addition of silver to bronzes containing 5 to 10 per cent of tin increases their hardness and annealing temperature, effects that are particularly noticeable with 1 per cent or more of silver and for annealing periods of short duration.

* * *

Cast-Iron Borings Used in Chemical Industry

Millions of pounds of cast-iron chips resulting from the machining of cast iron are used in making explosives, dyes, and chemicals for preserving rubber. The E. I. du Pont de Nemours & Co., Inc., use more than 100,000,000 pounds of these chips annually in their own plants and in the ordnance plants operated by the company for the Government. Soft oil-free borings, such as result from machining cast-iron piston-rings, transmission housings, pulleys, etc., are very much needed for this purpose in carload lots. Plants that have large quantities of cast-iron borings are asked to communicate with the du Pont company with a view to selling their borings to that company instead of remelting them or shipping them to blast furnaces.

MACHINERY'S DATA SHEETS 503 and 504

MOMENT OF INERTIA, ETC., FOR STANDARD-WEIGHT STRUCTURAL CHANNELS—1

Values of Moment of Inertia *I*, Section Modulus *S*, and Radius of Gyration *r* for Two Channels Placed Back to Back at Varying Distances Apart

Size, Inches	Weight of One Channel, Pounds	Area of Two Channels, Square Inches	Flange Width, Inches	Factor	Distance Apart *B*, Inches										
					0	1/4	5/16	3/8	7/16	1/2	9/16	5/8	11/16	3/4	13/16
					Values of *I*, *S*, and *r*										
3	4.1	2.38	1.41	I	0.92	1.16	1.26	1.33	1.43	1.53	1.64	1.74	1.85	1.95	2.08
				S	0.65	0.76	0.81	0.83	0.88	0.92	0.97	1.01	1.05	1.09	1.15
				r	0.62	0.698	0.727	0.747	0.777	0.802	0.832	0.855	0.880	0.905	0.946
4	5.4	3.12	1.58	I	1.3	1.67	1.83	1.94	2.07	2.20	2.36	2.48	2.64	2.82	2.98
				S	0.82	0.98	1.06	1.10	1.15	1.2	1.27	1.31	1.37	1.45	1.51
				r	0.65	0.730	0.765	0.790	0.815	0.840	0.870	0.886	0.918	0.952	0.976
5	6.7	3.9	1.75	I	1.9	2.47	2.58	2.74	2.92	3.10	3.26	3.46	3.68	3.88	4.08
				S	1.09	1.32	1.35	1.41	1.48	1.55	1.61	1.68	1.76	1.83	1.90
				r	0.69	0.795	0.815	0.838	0.865	0.892	0.915	0.940	0.960	0.995	1.02
6	8.2	4.78	1.92	I	2.7	3.38	3.58	3.76	4.02	4.22	4.46	4.68	4.94	5.18	5.44
				S	1.39	1.65	1.72	1.79	1.87	1.94	2.03	2.10	2.18	2.25	2.34
				r	0.74	0.840	0.864	0.886	0.916	0.940	0.965	0.990	1.012	1.040	1.067
7	9.8	5.7	2.09	I	3.7	4.56	4.78	5.00	5.32	5.60	5.90	6.20	6.46	6.80	7.10
				S	1.76	2.05	2.13	2.19	2.30	2.39	2.49	2.59	2.65	2.76	2.86
				r	0.80	0.886	0.916	0.935	0.966	0.983	1.012	1.032	1.062	1.092	1.113

Note: The radius of gyration with respect to axis 1–1 is equal to that with respect to axis 2–2 when *B* is 1.31 inches for 3-inch size channels; 2.06 inches for 4-inch size; 2.79 inches for 5-inch size; 3.52 inches for 6-inch size; 4.22 inches for 7-inch size; 4.94 inches for 8-inch size; 5.63 inches for 9-inch size; 6.33 inches for 10-inch size; 7.67 inches for 12-inch size; 9.50 inches for 15-inch size; 11.27 inches for 18-inch size channels.

MACHINERY'S Data Sheet No. 503, December, 1943

Compiled by J. Lewis Luckenbach

MOMENT OF INERTIA, ETC., FOR STANDARD-WEIGHT STRUCTURAL CHANNELS—2

Values of Moment of Inertia *I*, Section Modulus *S*, and Radius of Gyration *r* for Two Channels Placed Back to Back at Varying Distances Apart

Size, Inches	Weight of One Channel, Pounds	Area of Two Channels, Square Inches	Flange Width, Inches	Factor	Distance Apart *B*, Inches										
					0	1/4	5/16	3/8	7/16	1/2	9/16	5/8	11/16	3/4	13/16
					Values of *I*, *S*, and *r*										
8	11.5	6.72	2.26	I	4.9	5.96	6.32	6.50	6.90	7.22	7.56	7.92	8.28	8.66	9.06
				S	2.15	2.50	2.61	2.65	2.78	2.88	2.98	3.08	3.18	3.30	3.41
				r	0.85	0.942	0.970	0.986	1.015	1.035	1.060	1.085	1.110	1.135	1.160
9	13.4	7.78	2.43	I	6.4	7.88	8.12	8.58	8.96	9.34	9.74	10.16	10.60	11.06	11.54
				S	2.67	3.08	3.14	3.28	3.38	3.49	3.60	3.71	3.82	3.95	4.08
				r	0.90	1.015	1.022	1.052	1.080	1.100	1.12	1.142	1.162	1.190	1.212
10	15.3	8.94	2.6	I	8.2	9.80	10.32	10.76	11.22	11.68	12.14	12.66	13.16	13.72	14.26
				S	3.18	3.59	3.74	3.86	3.98	4.10	4.22	4.35	4.48	4.62	4.75
				r	0.96	1.046	1.072	1.097	1.120	1.145	1.168	1.190	1.210	1.240	1.260
12	20.7	12.06	2.94	I	13.4	16.12	16.72	17.36	18.00	18.68	19.40	20.10	20.84	21.56	22.42
				S	4.66	5.25	5.40	5.53	5.70	5.85	6.03	6.18	6.36	6.50	6.72
				r	1.05	1.155	1.175	1.200	1.220	1.245	1.270	1.290	1.315	1.340	1.365
15	33.9	19.8	3.4	I	28.8	33.14	34.16	35.36	36.60	37.80	39.00	40.40	41.80	43.10	44.50
				S	8.45	9.38	9.60	9.85	10.10	10.35	10.60	10.90	11.20	11.45	11.70
				r	1.20	1.295	1.315	1.335	1.360	1.380	1.410	1.430	1.455	1.470	1.500
18	42.7	24.96	3.95	I	50.0	56.50	58.00	59.70	61.20	62.90	64.70	66.50	68.20	71.00	72.20
				S	12.7	13.82	14.15	14.40	14.70	14.95	15.25	15.60	15.90	16.45	16.60
				r	1.42	1.510	1.525	1.545	1.570	1.585	1.610	1.632	1.652	1.690	1.702

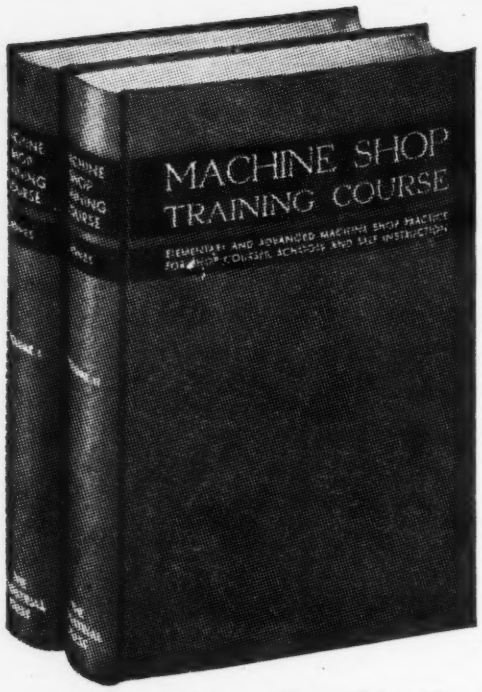
Note: For radii of gyration with respect to axis 1–1 equal to that with respect to axis 2–2, see note on Data Sheet No. 503.

MACHINERY'S Data Sheet No. 504, December, 1943

Compiled by J. Lewis Luckenbach

Machine Shop Training Course

WITH BLUEPRINT READING CHARTS



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This standard treatise on machine shop practice in two volumes is for the shop man who wants to supplement his own experience with a broad fund of practical knowledge; for use as a textbook and guide in shop training courses; for technical or trade schools; for designers who want the fundamentals of machine shop practice; for mechanical engineering students.

The MACHINE SHOP TRAINING COURSE contains about 1000 pages of questions and answers. These questions deal with the elements of machine shop practice and other subjects closely allied to the work of the shop. The answers are packed with useful facts, shop rules, typical shop problems and their solutions. 524 drawings and photographs illustrate all kinds of machining operations, cutting tools, gages, etc.

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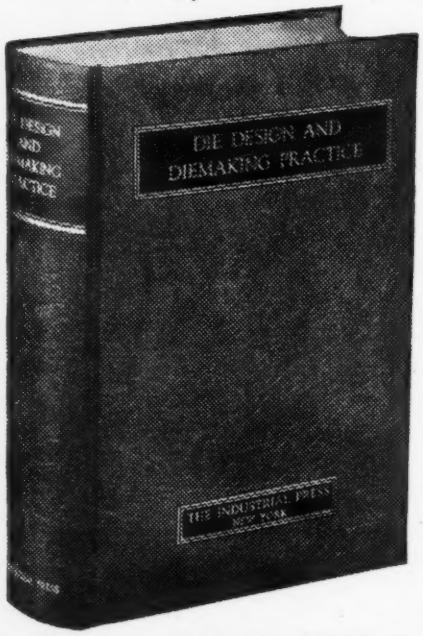
THE MOST COMPLETE TREATISE IN EXISTENCE ON DIES



956 pages, 590 illustrations

If you design, make or use dies for blanking, forming or drawing sheet-metal parts, here is a veritable die designer's and diemaker's bible. This die book presents not only descriptions and drawings of a tremendous variety of dies, but a vast amount of data representing a lot of boiled down and costly die experience. Dies of the same general classes are grouped together in chapters. The drawing dies have been placed into chapters according to the general shapes of the parts produced, to facilitate finding the type of die for producing a given shape.

Price $6—payable if desired $2 with order and $2 monthly for two months.

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News of the Industry

California

DAVID A. NELSON has joined the Detroit Broach Co., Detroit, Mich., as vice-president, and will also be general manager of the company's West Coast plant at Beverly Hills, Calif. Mr. Nelson has been associated with the Colonial Broach Co. for the last eighteen years.

David A. Nelson, Vice-president of Detroit Broach Co., and Manager of West Coast Branch

W. B. MERRIAM, general manager of the Globe Products Mfg. Co., 3380 S. Robertson Blvd., Los Angeles, Calif., manufacturer of the Globe miller, portable milling attachment for standard lathes, and other machine tools, has been appointed executive vice-president. He became connected with the company in September, 1942.

HARVEY A. CRAIG has been made district sales manager of the Republic Steel Corporation in the Los Angeles district, and ARTHUR C. GELDNER assistant district sales manager. For many years Mr. Craig was vice-president of the Rheem Mfg. Co., Richmond, Calif.

JOHN B. ROSS, formerly with The Linde Air Products Co., has been appointed to the West Coast engineering office at Los Angeles, Calif., of the firm of Handy & Harman, New York City, makers of silver brazing alloys and other metal products.

DR. NATHANIEL BAUM has been appointed head of the new organic research laboratory of Turco Products, Inc., 6135 S. Central Ave., Los Angeles 1, Calif.

Illinois

LINK-BELT CO., Chicago, Ill., announces the following promotions: EDWARD J. BURNELL, heretofore vice-president and general manager in charge of the Pershing Road plant operations and central division sales, has been transferred to the executive offices of the company at 307 N. Michigan Ave., Chicago 1, Ill., and has assumed the position of vice-president in charge of sales for the entire company. NELSON L. DAVIS, WILLIAM H. KINKEAD and C. WALTER SPALDING will assist Mr. Burnell in his new post. HAROLD L. HOEFMAN, manager of the company's Atlanta plant, succeeds Mr. Burnell as general manager of the Pershing Road plant. RICHARD B. HOLMES, district manager at Indianapolis, will take Mr. Hoefman's place as manager of the Atlanta plant. DAVID E. DAVIDSON, district engineer at the company's Detroit office, succeeds Mr. Holmes as district manager at the Indianapolis office.

DR. DAVID S. JACOBUS, retired consulting engineer of the Babcock & Wilcox Co., was awarded the Samuel Wylie Miller Memorial Award at the twenty-fourth annual meeting of the American Welding Society in Chicago. The medal was awarded to Dr. Jacobus for "the most conspicuous contribution to research, standardization, and advancement of welded construction."

KENNETH HALL has been appointed factory representative in the midwestern territory covering Indiana, Illinois and Wisconsin, for the Snyder Tool & Engineering Co., Detroit, Mich. Mr. Hall was previously process engineer at the Plymouth plant of the Chrysler Corporation. He will make his headquarters at 1358 Berkley St., Deerfield, Ill.

GRAND SPECIALTIES CO., manufacturer of "Quikcet," "Dual-Grip," "Quick Lockcet," and other time- and labor-saving clamps, including C-clamps of various types, has completed and moved into its new manufacturing plant at Grand and Troy Aves., Chicago, Ill.

PAUL E. FLOYD has returned from Washington, where he was connected with the Iron and Steel Branch of the War Production Board, to resume his former position as district manager in the Chicago branch office of the Allegheny Ludlum Steel Corporation.

QUICKWORK DIVISION OF THE WHITING CORPORATION, Harvey, Ill., announces that the division is in a position to render complete service covering the design and construction of special welding positioners.

JOSEPH B. TERBELL has been appointed first vice-president of the American Manganese Steel Division of the American Brake Shoe Co., Chicago, Ill., with which he has been connected for fifteen years.

Michigan and Minnesota

W. F. NEWBERY has been appointed sales manager of the Industrial Division of the Detrex Corporation, Detroit, Mich., formerly known as Detroit Rex Products Co., manufacturer of metal-cleaning equipment and materials. HARRY S. TWEEDY has been appointed manager of the Field Service Division. Mr. Tweedy has been chief inspector of production in all Detrex plants since December, 1940.

JAMES R. WEAVER has been made manager of the Naval Ordnance plant at Center Line, near Detroit, Mich., operated by the Westinghouse Electric & Mfg. Co. Mr. Weaver has been man-

James R. Weaver, Manager of Westinghouse Naval Ordnance Plant in Michigan

ager of the Westinghouse-operated Navy plant at Louisville, Ky., since 1940. He is succeeded by C. E. SHIPLET as manager of that plant. Mr. Shiplet was formerly superintendent of the Louisville plant.

DON S. CONNOR has been appointed director of field engineering of the Micromatic Hone Corporation, Detroit, Mich., manufacturer of honing machines and honing equipment. LAWRENCE S. MARTZ has been made assistant to the president. Mr. Martz will continue to direct the technical service activities of the company, and will also coordinate the company's human and public relations program.

Don S. Connor, New Director of Field Engineering, Micromatic Hone Corporation

Lawrence S. Martz, Assistant to President of Micromatic Hone Corporation

MICHIGAN TOOL CO., Detroit, Mich., has opened service and sales district offices at 601 Tower Bldg., South Bend, Ind., with T. S. MELLEN in charge, and at 1409 Union Central Life Insurance Bldg., Cincinnati, Ohio, with E. W. BROCK in charge.

GERALD CARLISLE has been appointed controller and assistant treasurer of the Micromatic Hone Corporation, Detroit, Mich., manufacturer of honing machines and honing equipment.

TAMPA MFG. CO., manufacturer of tools, jigs, gages, and fixtures, is now located at 2621 Virginia Park, Detroit 6, Mich.

LINK-BELT CO., 307 N. Michigan Ave., Chicago, Ill., has purchased the manufacturing plant and inventory of the LINK-BELT SUPPLY CO. in Minneapolis, Minn. RAY S. WOOD has been appointed manager of that plant.

New England

CLAYTON R. BURT, formerly president and general manager of the Niles-Bement-Pond Co., West Hartford, Conn., has been elected chairman of the board. Mr. Burt will continue to spend his full time at the West Hartford plant, which has been under his executive management since 1924. CHARLES W. DEEDS has been elected president and general manager of the company. He also retains the active management of the Chandler-Evans Corporation, which was recently acquired by the Niles-Bement-Pond Co. Previous to becoming president of the Chandler-Evans Corporation in 1938, Mr. Deeds was vice-president and general manager of the Pratt & Whitney Aircraft Division of the United Aircraft Corporation, East Hartford, Conn.

Blank & Stoller

Clayton R. Burt, Chairman of the Board, Niles-Bement-Pond Co.

Charles W. Deeds, President and General Manager of the Niles-Bement-Pond Co.

NILES-BEMENT-POND CO., West Hartford, Conn., has acquired the CHANDLER-EVANS CORPORATION, South Meriden, Conn. The Chandler-Evans plants at South Meriden and Wallingford, Conn., and Dayton, Ohio, will continue to operate under the same management and with the same personnel. CHARLES W. DEEDS continues as president of the subsidiary company, which will build and market a line of accessories used in airplane engines. B. H. GILPIN, executive vice-president of the Chandler-Evans Corporation since 1939, will become vice-president and general manager of the subsidiary company. He will conduct the Chandler-Evans activities at the South Meriden plant. Mr. Gilpin was formerly connected with the Pratt & Whitney Aircraft Division of the United Aircraft Corporation.

RALPH M. JOHNSON has been appointed general sales manager of grinding wheels and abrasive grain for the entire United States by the Norton Co., Worcester, Mass. He will make his headquarters at the Worcester plant. Mr. Johnson has been Norton western sales manager since 1939. He joined the research staff of the company in 1915, shortly after graduating from Worcester Polytechnic Institute, working first in the organic laboratory and then in the mechanical laboratory. Then he worked for five years in the sales engineering department, ending his work there as assistant sales engineer. In 1922, he was placed in charge of the Connecticut sales territory, and in 1928 was made manager of the Philadelphia warehouse and sales dis-

FOR

SERVICE

"beyond the call of duty"

on the production front

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You'd naturally expect the man who sells you cutting fluids, grinding coolants, rust preventives and similar products to be able to make helpful suggestions on their use and application in your plant. But, if this is *all* you've come to expect, your first experience with a *Quaker Process Engineer* will undoubtedly be somewhat of a surprise. For these highly trained men are constantly distinguishing themselves on the production front by rendering "service *beyond* the call of duty."

One of our men, for example, recently devoted several days to the designing of a permanent mold for a customer who was stymied by this particular problem. Another Quaker Process Engineer *spent several weeks in a customer's plant studying and locating the reason for a baffling drop in machining results on a certain airplane part.*

In fact, it is not at all uncommon to find a *Quaker Process Engineer* serving as a consultant on the layout of a new plant . . . or sitting in with a laboratory or engineering staff to work out a new manufacturing process.

MUST MEET RIGID QUALIFICATIONS

To qualify as a* Quaker Process Engineer *a man must be a graduate chemist and/or engineer and must have had at least five years' experience in process and production work in the metal manufacturing industry. He is, therefore, intimately acquainted with the* operations *which Quaker Chemical serves with its products. He is then given additional training in our laboratories and in the field . . . so that he knows thoroughly Quaker* engineering methods and products *. . . and how to apply them to get maximum production.

With such a wealth of training and experience, a *Quaker Process Engineer's* help can often be extremely valuable in curing troubles—whether connected with processes served by Quaker Chemical products or some other operation in a metal manufacturing plant.

SPIRIT OF FRIENDLY HELPFULNESS

Why do we permit—even encourage—our men to devote so much time to "service beyond the call of duty"? Simply because our whole business philosophy here at Quaker is based on a spirit of friendly helpfulness . . . and the conviction that, in the long run, we will benefit by serving our customers to the fullest extent of our ability.

It is part of the same spirit of service to industry which led us, years ago, to dedicate our extensive research facilities to the task of locating processing problems which we felt had never been handled quite satisfactorily . . . and of developing new products or processes to overcome these troubles.

LABORATORY, NEW PRODUCTS AT HIS SERVICE

The facilities of our research laboratory—and the many new type products which have come out of it—stand behind your local* Quaker Process Engineer *. . . to help him solve your production problems or improve present results. So why not call him in and get acquainted? You'll find him an interesting, friendly sort of fellow . . . with a fund of useful knowledge on which you can draw. Simply write or wire—

QUAKER CHEMICAL PRODUCTS CORP.

CONSHOHOCKEN, PA.

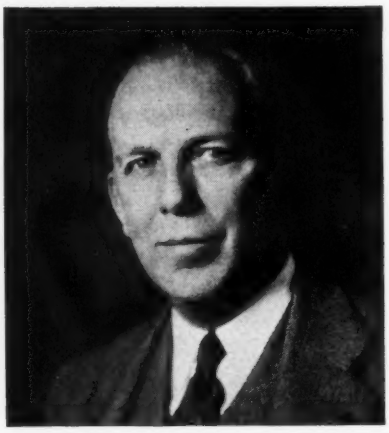
Other Plants in CHICAGO and DETROIT . . . . Warehouse Stocks in Principal Industrial Centers

Ralph M. Johnson, General Sales Manager of Grinding Wheels and Abrasive Grain of Norton Co.

trict. He continued in that capacity until 1934, when he was brought back to Worcester as chief sales engineer, leaving that post to take charge of Norton sales operations in the central and far western sections.

C. V. TOPLIFFE has been made manager of the Boston district office of Cutler-Hammer, Inc., Milwaukee, Wis. He takes the place of W. E. ADDICKS, now New York district manager.

WILLIAM R. MOORE has been elected a vice-president of the Norton Co., Worcester, Mass. Mr. Moore has been connected with the Norton Co. for many years, and since 1939 he has been general sales manager of the Abrasive Division. He has also long been identified with the activities of the Grinding Wheel Manufacturers Association, and is a director of the Abrasive Grain Association.



William R. Moore, Newly Elected Vice-president of the Norton Co.

New Jersey

JOHN M. DEMAREST, consulting and plant engineer for the last twenty-five years, and recently associated with the War Production Board in charge of aircraft plant expansions, has been named plant manager of the Wright Aeronautical Corporation plants in the Paterson, N. J., area. Mr. Demarest became connected with the Wright Aeronautical Corporation eight months ago as assistant to the general superintendent.

LUTHER H. ATKINSON has been appointed vice-president in charge of sales of the Elastic Stop Nut Corporation of America, Union, N. J. He was

Luther H. Atkinson, Vice-president in Charge of Sales of the Elastic Stop Nut Corporation

formerly vice-president in charge of marketing for the Weyerhaeuser Sales Co., of St. Paul, Minn.

TITEFLEX METAL HOSE CO., Newark, N. J., announces that JOHN DUNN, formerly production manager, has been appointed works manager in charge of all the plants of the company. Mr. Dunn has been with the Titeflex organization since 1935. ARTHUR F. PENNINGTON, formerly superintendent, succeeds Mr. Dunn as production manager. Mr. Pennington has been with the company since 1936.

HELLER BROTHERS CO., Newark, N. J., manufacturer of files, rasps, tools, and steel, has acquired the good will, trade name, and patents of the Cleveland File Co., Cleveland, Ohio. JOHN E. NICKLIS, formerly associated in an executive capacity with the Cleveland organization, is now connected with Heller Brothers Co.

New York

WILLIAM L. STANCLIFFE has been appointed vice-president in charge of sales of the American Car & Foundry Co., 30 Church St., New York City, succeeding the late William E. Hedgcock. Mr. Stancliffe will retain the handling of contracts with the Government connected with the manufacture and sale of munitions of war.

CLARENCE G. STOLL, president and director of the Western Electric Co., 195 Broadway, New York City, has been elected a member of the board of governors of the National Electrical Manufacturers Association.

ROBERT B. MCCOLL, vice-president in charge of manufacturing of the American Locomotive Co., Schenectady, N. Y., has been elected a director.

Ohio

SHEFFIELD CORPORATION, Dayton, Ohio, manufacturer of gages, measuring instruments, optical form grinders, precision thread grinders, chamfering machines, and other machine tools, has recently appointed the following representatives: W. P. CHILDS, Atlanta, Ga.; R. L. CRANE MACHINERY Co., Buffalo, N. Y.; BRYANT MACHINERY & ENGINEERING CO., Chicago, Ill.; STRONG, CARLISLE & HAMMOND CO., Cleveland, Ohio; C. H. GOSIGER MACHINERY CO., Dayton, Ohio; C. H. REYNOLDS, Detroit, Mich.; MARSHALL & HUSCHART MACHINERY CO., Indianapolis Ind., JOHN C. EIDE CO., Minneapolis, Minn.; GENERAL MACHINERY CORPORATION, Boston, Mass.; HARRINGTON-WILSON-BROWN CO., New York City; W. E. SHIPLEY MACHINERY CO., Philadelphia, Pa.; F. W. SCHIEFER MACHINERY CO., Rochester, N. Y.; ROBERT R. STEPHANS MACHINERY CO., St. Louis, Mo.; J. F. OWENS MACHINERY CO., Syracuse, N. Y.

MONARCH MACHINE TOOL CO., Sidney, Ohio, announces the establishment of new branch sales offices in Detroit, Mich., and Cleveland, Ohio. JEROME A. RATERMAN, formerly vice-president and treasurer, has been made executive vice-president of the company and will retain his position as treasurer. MARTIN J. LUTHER, Chicago branch manager since 1930, has been made general sales manager, with headquarters in Sidney. KERMIT KUCK, Newark, N. J., branch manager for the last three years, has been appointed chief engineer. STANLEY A. BRANDENBURG, who has represented the company on the East Coast for six years, will be branch manager of the new Detroit office, which is located in the Fisher Building. HUGH W. ROBINSON, Indianapolis branch manager since 1937, will head the Cleveland office.

JUST OFF THE PRESS

NEW, REVISED REEVES CATALOG

NEW— Reducer-Type Transmission

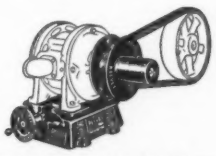
NEW— Vari-Speed Jr.

NEW— Sizes and Speed Ratios

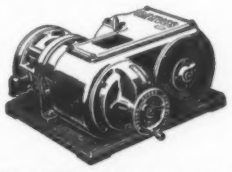
NEW— Diagrams and Tables

This book is more than a catalog. It is a complete, authoritative textbook on variable speed control, issued by REEVES, originators of the Variable Speed Transmission and recognized leader in the specialized field of speed control engineering. Its 128 pages are packed with practical information for manufacturers in every line of industry. This book gets right down to the fundamentals of accurate speed control—what it is—how engineered and applied—the remarkable advantages it offers. Contains over 200 illustrations, diagrams, and tables. It is written out of the experience of REEVES engineers in applying infinite speed adjustability to more than 260,000 machines in all types of plants. Regardless of what you manufacture, you will find this book valuable and helpful. Since it is being distributed only to those who request it, use coupon below.

VARIABLE SPEED TRANSMISSION for providing infinite, accurate speed flexibility over wide range.



VARI-SPEED MOTOR PULLEY converts any standard constant speed motor to a variable speed drive.



MOTODRIVE combines motor, speed varying mechanism and reduction gears in single compact unit.

A COMPLETE, AUTHORITATIVE TEXTBOOK ON Speed Control—

Here are a few of many features that make it important for you to have this book.

A clear, concise explanation of the necessity for variable speed control in modern manufacturing processes.

Information on new REEVES Reducer-Type Transmission, which combines accurate speed adjustability and speed reduction in one compact unit.

Full description of the REEVES Vari-Speed Jr., a light weight, light h.p. simplified unit which utilizes standard section V-belts.

New sizes and speed ratios of REEVES Motodrive and Vari-Speed Motor Pulley.

Requisites of modern speed control equipment—a valuable check-list to use in selecting the proper unit for your needs.

Automatic variable speed control and how REEVES provides it through three control systems—hydraulic, mechanical and differential.

Engineering data in convenient, reference form—tables for selecting correct size and speed range, dimension diagrams and other installation information.

MAIL THIS COUPON FOR YOUR COPY . . . TODAY!

REEVES PULLEY COMPANY, Dept. M, COLUMBUS, INDIANA

Send copy of your new, revised Catalog-Manual G-435, on Variable Speed Control.

Name..... Title.....

Company..... City..... State.....

FRANK H. HARRISON, manager of manufacturing for the International Harvester Co., and E. J. HARRINGTON, coordinator of planning, production, and material problems for the Lockheed Aircraft Corporation, have been elected vice-presidents of the Curtiss-Wright Corporation, 30 Rockefeller Plaza, New York City. Mr. Harrison will make his headquarters for the present at the Columbus, Ohio, warplane plant of the corporation, and will be in complete charge of operations there. Mr. Harrington will be located at the New York offices as a member of the executive manufacturing staff, but is temporarily assigned to the Columbus factory.

W. W. GALBREATH has been made executive vice-president of the Pressed Metal Institute. Mr. Galbreath was for many years president of the Alliance Porcelain Products Co., and is well known in the steel and stamped-metal industries. In his new post, he will give special attention to the Institute's post-war problems and planning. The headquarters of the Institute have been transferred from New York to Cleveland. The Cleveland office is at 829 Union Commerce Building.

LAUGHTER CORPORATION has been formed to succeed the PRODUCTION PRODUCTS Co., Dayton, Ohio. The new corporation will manufacture machine tools, dies, jigs, gages, and special machinery. D. R. LAUGHTER is president; C. W. WILSON, vice-president in charge of engineering; GEORGE LAUGHTER, vice-president in charge of sales; and W. B. KINDRICK, vice-president in charge of manufacturing.

E. W. BROCK, formerly service manager of the Genesee Tool Co., Fenton, Mich., manufacturer of Tomahawk high-speed steel cutting tools, is now representing that company as service-sales manager of a newly opened factory branch office at 1409 Central Life Insurance Building, Cincinnati, Ohio.

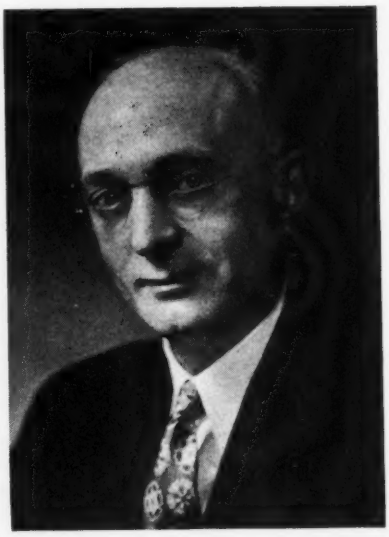
LINCOLN ELECTRIC Co., Cleveland, Ohio, has instituted a five-day engineering course at the company's plant to be attended by engineering, research, and welding executives. The intention is to hold these courses monthly. Further information can be obtained from the company.

DETROIT TAP & TOOL Co., Detroit, Mich., has established an office at Cleveland, Ohio, in the Penton Bldg., with GEORGE PIERCE in charge. An office has also been opened in Dayton, Ohio, at 710 Harries Bldg., with H. E. ROEDTER in charge.

COLONIAL BROACH Co., Detroit, Mich., has opened direct branch offices at 1506 Toledo Trust Bldg., Toledo, Ohio. MORRIS TEAGUE and W. F. HAVERSTOCK will be in charge of the new offices.

Pennsylvania

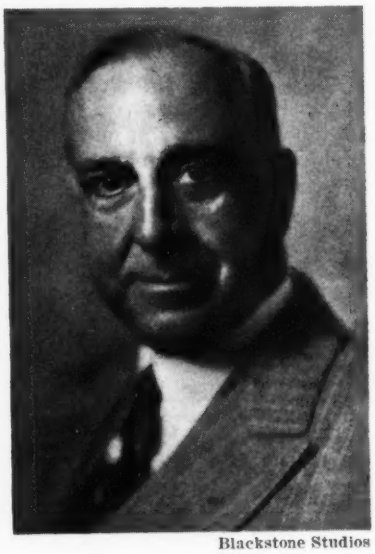
JOHN C. GRAF has been appointed sales manager of the Hydraulic Press and Special Equipment Department of the Baldwin Southwark Division of



John C. Graf, Sales Manager Hydraulic Press and Special Equipment Department of Baldwin Southwark

the Baldwin Locomotive Works, Philadelphia, Pa. Mr. Graf entered the employ of the Southwark Foundry & Machine Co., now the Baldwin Southwark Division, in 1915. Since 1925, he has been New England sales manager.

VANADIUM-ALLOYS STEEL Co., Latrobe, Pa., at a recent meeting of the board of directors, elected ROY C. McKENNA chairman of board, FLOYD ROSE president, and JAMES P. GILL vice-president.



Blackstone Studios

Floyd Rose, Newly Elected President of the Vanadium-Alloys Steel Co.

C. A. SMITH, who has been with the Westinghouse Electric & Mfg. Co. for fifty-one years, has been appointed assistant to THOMAS I. PHILLIPS, vice-president in charge of the East Pittsburgh division. Mr. Smith joined the Westinghouse organization in 1892 as an apprentice; since then, he has served successively as assistant foreman, general foreman, assistant superintendent, superintendent, and division manager.

VICTOR P. SHAFFER has been named engineer in charge of design for the Process Division of the H. K. Porter Co., Inc., Pittsburgh, Pa.

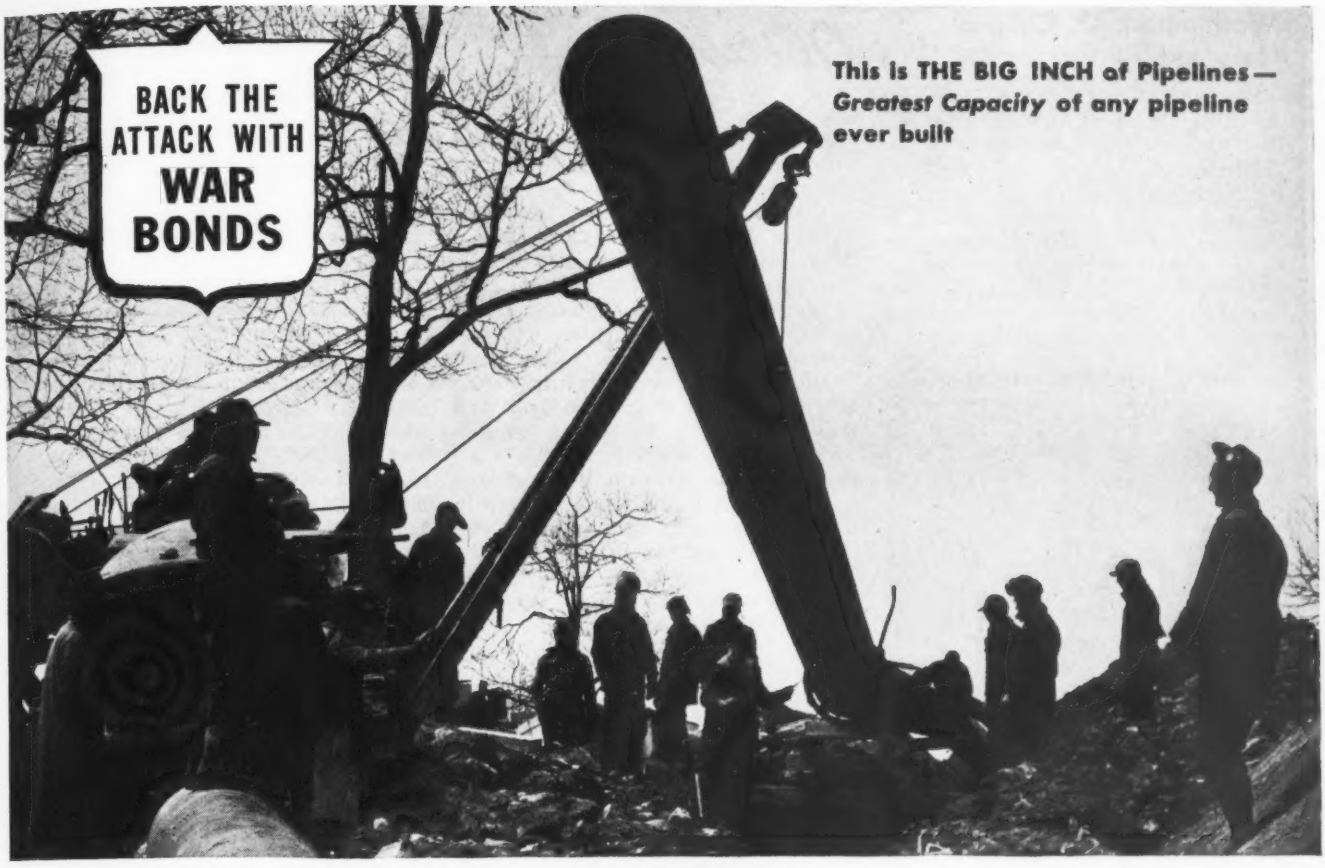
JOHN C. REDMOND has been appointed research engineer and chief analytical chemist for Kennametal Inc., Latrobe, Pa. He was previously associated

John C. Redmond, Research Engineer and Chief Analytical Chemist of Kennametal, Inc.

with the Youngstown Sheet & Tube Co., where he was engaged in chemical analysis, research, and process development.

H. W. TENNEY, formerly assistant director of the Westinghouse Research Laboratories, has been made assistant to THOMAS I. PHILLIPS, vice-president in charge of the company's Pittsburgh divisions. Mr. Tenney has been with the Westinghouse organization since 1920.

ALLEGHENY LUDLUM STEEL CORPORATION, Brackenridge, Pa., announces that the company has recently acquired the CARBIDE ALLOY CORPORATION, of New York City, which will hereafter be operated as Allegheny Ludlum's Carbide Division.



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OF ROLLER BEARINGS

These "Inch Series" Hyatts...like their famous pipeline namesake...have tremendous capacity... measured in tons and hundreds of tons.

And...as a further advantage...they are made in fractional size bores, for shafts from 4″ diameter upwards.

Originally designed for the massive, heavily-loaded, relatively slow-moving oil well machinery, the use of this type of Hyatt Bearing (70,000 series) quickly spread.

Today they are serving and saving in mining equipment, industrial locomotives, power presses, pillow blocks, cranes and steel mill cars...as well as in numerous types of fighting equipment.

Keeping pace with the demands of industrial designers for the latest and best in anti-friction bearings has been Hyatt's job for fifty-one years.

The "Big Inch" is just one of the several types of Hyatt Bearings now being made. Each of them is designed for specific needs and purposes.

Call on our engineers for information about their profitable application to your products.

HYATT BEARINGS

Division of GENERAL MOTORS

HYATT BEARINGS DIVISION • GENERAL MOTORS CORPORATION • HARRISON, N. J.

Washington, D. C., and Maryland

BRIGGS CLARIFIER CO., 1339 Wisconsin Ave., Washington 7, D. C., has reorganized its sales department into two divisions, one for automotive and one for industrial distribution. HENRY T. MOORE is general sales manager. E. K. BURGESS and J. H. NASH are assistant sales manager for the automotive and industrial divisions, respectively. The company also announces the appointment of J. J. STROUD as engineering and sales representative for the state of Kentucky, with headquarters at Paducah. J. M. WILLIS has been appointed Ohio state sales and engineering representative, with headquarters at Springfield.

Henry T. Moore, Recently Appointed General Sales Manager, Briggs Clarifier Co.

WALTER J. EWBANK has been appointed chief engineer of the Briggs Clarifier Co., Washington, D. C. In addition to filling his duties as chief engineer, Mr. Ewbank will head a department recently created in a reorganization plan designed to promote more thorough cooperation between the sales and engineering departments.

RHEEM RESEARCH PRODUCTS, INC., SUBSIDIARY OF RHEEM MFG. CO., announce the expansion and removal of their facilities, office, and manufacturing plant to 2523 Pennsylvania Ave., Baltimore 17, Md.

* * *

The annual index to MACHINERY covering the year September, 1942, to August, 1943 (Volume 49), is ready for distribution. Subscribers can obtain copies upon request.

Obituaries

WILLIAM E. HEDGCOCK, vice-president in charge of sales of the American Car & Foundry Co., New York, died on October 26 at the Wickersham Hospital in New York City after a brief illness. Mr. Hedgcock had been associated with the American Car & Foundry Company and its predecessors for over sixty years. He was seventy-six years of age.

Mr. Hedgcock was born in Jeffersonville, Ind., on October 1, 1867, and went to work at the age of fourteen with the Ohio Falls Car Mfg. Co. When that company became part of the American Car & Foundry Co. group in 1899 he was transferred to the St. Louis offices and went to work in the purchasing department, subsequently becoming purchasing agent. In July, 1923, he was elected assistant vice-president in charge of sales, and in October, 1925, was placed in charge of the eastern sales district. In March, 1940, he became acting head of the sales department of the company, and about a year later was appointed vice-president in full charge of sales.

Mr. Hedgcock was vice-president of the American Railway Car Institute. He was a director of the American Car & Foundry Securities Corporation and the American Car & Foundry Export Co. He held memberships in the Iron and Steel Institute, Commerce and Industry Association of New York, the New York Railroad Club, and the Railroad Machinery Club, of which last mentioned he was also governor. He is survived by his widow, two sons, and a daughter.

M. W. ROGERS, president of the Universal Unit Machinery Corporation, and the Davis & Thompson Co., Milwaukee, Wis., died of a heart ailment November 4 at St. Luke's Hospital, Chicago, Ill. For a period of twenty years, Mr. Rogers was associated with the Caterpillar Tractor Co., Peoria, Ill., where he was general factory manager. After a short period of retirement, he was asked to contribute his vast knowledge of production methods to the war effort, and he became president of the Universal Unit Machinery Corporation and of the Davis & Thompson Co. He converted the Universal plant from the manufacture of power shovels to the making of Oerlikon gun mounts, and in doing so, organized the expansion of the company. The Davis & Thompson Co. constantly increased its production of special machine tools under his direction.

RICHARD FERGUSON, president of the Ferguson Gear Co., Gastonia, N. C., died on October 16 at his home, after a long illness. Previous to forming his own company, Mr. Ferguson was general manager of the Grant Lees Co., of Cleveland, Ohio. For many years, he had been a member of the American Gear Manufacturers Association.

JACOB FREDERICK DITTUS, for many years processing and sales engineer with the Detroit office of the Motch & Merryweather Machinery Co., died on October 29. Mr. Dittus was born in Cincinnati on September 26, 1890. He was educated in the public schools of Cincinnati, and was a graduate of Ohio Mechanics' Institute. In his early years, he was employed by the Lodge & Shipley Machine Tool Co. and the G. A. Gray Co., both of Cincinnati; the National Cash Register Co., at Dayton; and the Burroughs Adding Machine Co. of Detroit. During the first World War, he was connected with the Bureau of Standards. In November, 1919, he joined the Motch & Merryweather Machinery Co. as a demonstrator, and for the last twenty years has served as a process engineer and sales engineer in the application of machine tools.

Coming Events

DECEMBER 6-11—NINETEENTH EXPOSITION OF CHEMICAL INDUSTRIES at the Madison Square Garden, New York City. For further information, address International Exposition Co., 480 Lex- New York City.

DECEMBER 8-10—Forty-eighth annual convention of the NATIONAL ASSOCIATION OF MANUFACTURERS at the Waldorf-Astoria Hotel, New York City. For further information, address the Association at 14 W. 49th St., New York City.

JANUARY 10-14, 1944—Annual meeting and engineering display of the SOCIETY OF AUTOMOTIVE ENGINEERS at the Book Cadillac Hotel, Detroit, Mich. John A. C. Warner, secretary and general manager, 29 W. 39th St., New York City.

APRIL 25-28, 1944 — THIRD WAR PRODUCTION FOUNDRY CONGRESS AND FOUNDRY SHOW of the American Foundrymen's Association, to be held at the Memorial Auditorium, Buffalo, N. Y., in conjunction with the forty-eighth annual meeting of the Association. Executive office, American Foundrymen's Association, 222 W. Adams St., Chicago, Ill.

OCTORER 16-20, 1944 — Twenty-sixth annual meeting of the AMERICAN SOCIETY FOR METALS AND THE NATIONAL METAL CONGRESS, to be held at the Public Auditorium, Cleveland, Ohio.

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New Books and Publications

A.S.M.E. Mechanical Catalog and Directory (1944). 620 pages, 8 1/2 by 11 inches. Published by the American Society of Mechanical Engineers, 29 W. 39th St., New York City.

This is the thirty-third annual volume of the well-known mechanical catalogue and directory issued under the auspices of the American Society of Mechanical Engineers. The volume comprises: (1) Condensed catalogues, containing descriptions of thousands of items used by industry in manufacturing and maintenance. The catalogue section is arranged in alphabetical order by firm names. (2) Directory section, listing the names and addresses of manufacturers under alphabetically arranged product headings. (3) Trade name section, listing trade names in the mechanical industries, and giving the name and address of the manufacturer of the trade-named product. The 1944 volume contains a great many more catalogue descriptions than the 1943 edition. The classification of manufactured products has been expanded and revised.

Reading Blueprints in the Machine Industries. By Carlton Dwight. 144 pages, 9 by 12 inches; 104 illustrations. Published by the McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York City. Price, $1.75.

The author of this book, who is instructor in the Vocational Department of the Central and North High Schools, Binghamton, N. Y., points out that the expression "reading blueprints" has come to be accepted as indicating the interpretation of a mechanical drawing or copy of a drawing, such as a blueprint, black and white print, etc. To be able to read a drawing accurately has become increasingly important to tens of thousands of new employes in the machine industries. In preparing the book, the author had in mind two objectives: (1) To present the subject in such a manner that the student can proceed to its mastery easily and efficiently; and (2) to conform to modern industrial standards and practices. The text is intended to be complete within itself from the standpoint of instructional material.

Tungsten. By K. C. Li and Chung Yu Wang. 325 pages, 6 by 9 inches. Published by the Reinhold Publishing Corporation, 330 W. 42nd St., New York City. Price, $7.

This book on tungsten—one of the most strategic of war metals—covers its history, geology, ore-dressing, metallurgy, chemistry analysis, applications, and economics. The work is one of a series of scientific and technologic monographs sponsored by the American Chemical Society. Mr. Li points out in the foreword that the tungsten industry is still in its infancy and that, despite developments during the two world wars, tungsten is more than a strategic material; besides its use in high-speed steel, cutting tools, radio tubes, camera lenses, etc., he is of the opinion that there are many other fields in which it can be used. The book is intended to stimulate the interest of the reader in the future of tungsten.

Lubrication of Industrial and Marine Machinery. By William G. Forbes. 319 pages, 5 1/2 by 8 1/2 inches. Published by John Wiley & Sons, Inc., 440 Fourth Ave., New York City. Price, $3.50.

This book has been prepared to provide a manual that will aid engineers in solving everyday problems that arise in the lubrication of machines of various types. Unlike most engineering problems, there are very few convenient formulas that will provide rule-of-thumb answers to lubrication problems. In this book, every effort has been made to present information in a simple, clear manner, without the aid of involved theories. The information is nearly all the result of practical experience. Part of the book deals with the fundamentals of distillation, refining, and petroleum chemistry. Different types of machines and their lubrication are also dealt with.

Encyclopedia of Substitutes and Synthetics. Edited by Morris D. Schoengold, in collaboration with leading chemical and industrial laboratories. 382 pages, 6 by 9 inches. Published by Philosophical Laboratory, Inc., 15 E. 40th St., New York City. Price, $10.

This encyclopedia on substitutes and synthetics, which is said to be the first of its kind in any language in the world, should be valuable to industrial and laboratory chemists who are in search of new and improved materials. It covers products recently developed to replace critical materials that have become difficult or impossible to obtain on account of present world conditions. The book discusses substitutes of interest to all branches of industry, manufacture, and pharmaceutics. In addition to listing the materials, the editor has presented some of the chemical and physical properties, with the idea that further uses may be found for many of the items listed.

Machine Shop Projects. By Roy E. Knight. 112 pages, 7 3/4 by 10 1/4 inches; 25 full page drawings. Published by McKnight & McKnight, 109 W. Market St., Bloomington, Ill. Price, $1.

The author of this book is machine shop instructor at the Connersville Senior High School, Connersville, Ind. The book has been prepared to meet the needs for suitable projects that not only involve operations that should be taught, but that are also adaptable to the average training equipment in the machine shops of vocational and high schools. The book consists of a collection of twenty-five projects. A blueprint of each job is given, and on the opposite page is an operation sheet which provides space for bill of material, tools, operations, time required, and additional instructions. A list of twenty-five additional suggested projects is also included.

Production Control. By Asa S. Knowles and Robert D. Thomson. 271 pages, 5 3/4 by 8 1/2 inches. Published by the Macmillan Co., 60 Fifth Ave., New York City. Price, $2.50.

The various types of production control mechanisms described in this book are designed to achieve maximum effectiveness in operation and yet entail a minimum of overhead expense in their maintenance. The aim of the authors is not only to contribute toward simplification and standardization of production control mechanisms, but also to provide a practical and convenient manual for those who undertake production control ventures, particularly in connection with the war effort. Because the control of manufacturing operations and the control of costs go hand in hand, four chapters are included on cost control.

Salvage Manual for Industry. 245 pages, 6 by 9 inches. Published by Technical Service Section, Industrial Salvage Branch, Salvage Division, War Production Board, Washington, D. C. Procurable through the Superintendent of Documents, Government Printing Office, Washington, D. C., at 50 cents per copy.

This comprehensive salvage manual has been prepared and edited by seven engineers, assisted by a corps of about forty engineering or salvage experts. It contains instructions regarding efficient salvage methods and practices and covers practically every phase of industrial salvage. While the main purpose of the book is to speed war production, it should also be of value in post-war industry because of the economic benefits resulting from sound salvage practice.

Patent Law. By Chester H. Biesterfeld. 225 pages, 5 1/2 by 8 1/2 inches. Published by John Wiley & Sons, Inc., 440 Fourth Ave., New York City. Price, $2.75.

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This volume is the outgrowth of a series of lectures on patent law given by the author as an extension course for graduate and undergraduate students at the University of Delaware. The course, which comprised fifteen or sixteen weekly lectures, was designed primarily for chemists, engineers, and students who desired to acquire an understanding of the basic principles of the patent law. It should also be of value to those who are confronted with questions of patent law arising out of their daily research and technical work. The principles or rules discussed in the book are illustrated by the citation of leading cases and actual court decisions.

BLUEPRINT READING FOR THE SHIPBUILDING TRADES. By August E. Niederhoff. 87 pages, 8 1/2 by 11 inches; 70 illustrations. Published by the McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York City. Price, $2.

The aim of this book is to provide actual practice in the interpretation of blueprints and to present data, tables, and descriptive details pertaining to modern ship construction. The book also includes a list of abbreviations, ship terms, and a glossary of fabricating terms applicable to shipbuilding. Briefly, the book covers information on projection drawings and prints, structural steel nomenclature, welding symbols, details of ship construction, propulsion machinery, piping, and erection practice.

SHIPFITTING SIMPLIFIED. By L. L. Oberman. 126 pages, 5 by 7 1/2 inches; 31 illustrations. Published by the McGraw-Hill Book Co., New York City. Price, $1.50.

It has been the author's purpose to include in this book as much data as possible on the subject of shipfitting without dealing with wholly technical aspects. The material has been prepared and the text written with the student, apprentice, helper, and shipfitter in mind. Briefly, the book deals with the following subjects: Construction of ships; prefabrication; tools; symbols; routine procedure; and safety considerations. It also contains a glossary of ship and shipbuilding terms and a list of the most common abbreviations employed on ship drawings.

PLASTICS. By J. H. DuBois. 435 pages, 5 1/2 by 8 1/2 inches. Published by the American Technical Society, Drexel Ave. at 58th St., Chicago, Ill. Price, $3.75.

Great developments have taken place in plastic materials since the first edition of this book was published early in 1942. The book has been brought up to date to include these developments, and several new chapters have been added. Many important new materials and methods are described. A short section on vulcanized fiber has been added, because of the general importance of this material to engineers and fabricators.

SAFEGUARDING THE WOMAN EMPLOYE. 38 pages, 8 1/4 by 10 3/4 inches. Published by the Policyholders Service Bureau of the Metropolitan Life Insurance Co., 1 Madison Ave., New York 10, N. Y. Copies can be obtained without charge by executives who address the Bureau on their business stationery.

THE SOLUTION OF SIMULTANEOUS LINEAR EQUATIONS BY AN APPROXIMATION METHOD. By L. T. Wright, Jr. 6 pages, 8 1/2 by 11 inches. Published by Cornell University, Ithaca, N. Y., as Bulletin No. 31 of the Engineering Experiment Station. Price, 15 cents.

WARTIME WORKING CONDITIONS—MINIMUM STANDARDS FOR MAXIMUM PRODUCTION. 25 pages, 6 by 9 inches. Published as Special Bulletin No. 13 of the United States Department of Labor, Washington, D. C.

TRAINING WOMEN FOR WAR WORK. 16 pages, 6 by 9 inches. Published by the Apprentice-Training Service, Bureau of Training, War Manpower Commission, Washington, D. C.

* * *

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More than 850,000 pounds of tin have been saved by the General Electric Co., Schenectady, N. Y., in the last two years as a result of changes adopted by the company in its solders and babbitt alloys. Expressed in terms of tin required for cans (tin plated on both sides, as required for food products) this saving corresponds to the amount of tin required for approximately 825,000,000 cans.

STATEMENT OF THE OWNERSHIP, MANAGEMENT, ETC., REQUIRED BY THE ACTS OF CONGRESS OF AUGUST 24, 1912, AND MARCH 3, 1933,

of MACHINERY, published monthly at New York, N. Y., for October 1, 1943.

State of New York } ss.
County of New York }

Before me, a Notary Public in and for the state and county aforesaid, personally appeared Edgar A. Becker, who, having been duly sworn according to law, deposes and says that he is the treasurer of The Industrial Press, Publishers of MACHINERY, and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management, etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, as amended by the Act of March 3, 1933, embodied in section 537, Postal Laws and Regulations, printed on the reverse of this form, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are: Publisher, The Industrial Press, 140-148 Lafayette St., New York 13, N. Y.; Editor, Erik Oberg; Managing Editor Charles O. Herb; Business Managers, Robert B. Luchars, Edgar A. Becker, and Erik Oberg. The address of all the foregoing is 140-148 Lafayette St., New York 13, N. Y.

2. That the owners of 1 per cent or more of the total amount of stock are: The Industrial Press, Robert B. Luchars, Erik Oberg, Edgar A. Becker, Laura A. Brownell, and Franklin D. Jones, all of 140-148 Lafayette St., New York 13, N. Y.; First National Bank & Trust Co. of Montclair and Robert B. Luchars, Trustees (Beneficiaries unknown), Upper Montclair, N. J.; First National Bank & Trust Co. of Montclair and Leigh Roy Urban, Trustees (Beneficiaries unknown), Upper Montclair, N. J.; First National Bank & Trust Co. of Montclair and Kenneth D. Ketchum, Trustees (Beneficiaries unknown), Upper Montclair, N. J.; Paterson Savings Institution, Trustee (Beneficiaries unknown), Paterson, N. J.

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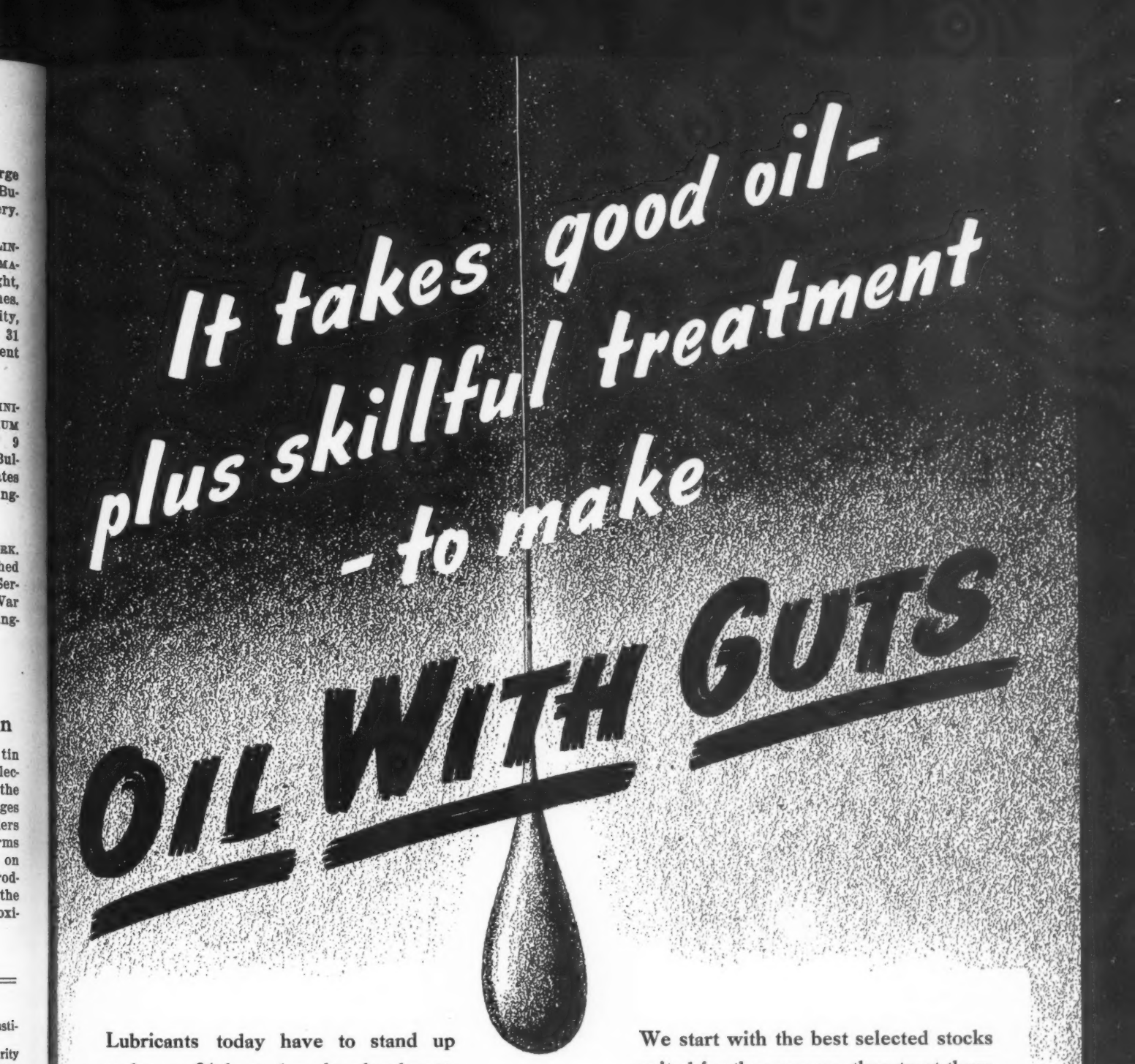
EDGAR A. BECKER, Treasurer

Sworn to and subscribed before me this 30th day of September, 1943

CHARLES P. ABEL

(SEAL) Notary Public, Kings County No. 292
Kings Register's No. 116-A-5
New York County No. 233, New York Register's No. 153-A-5
(My commission expires March 30, 1945)



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